POWER

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES

MARCH, 1943

tionary engineer's path to ine license shortened by new ning program—shore experi-ce, a month's schooling, and ngle voyage as junior officer, icensed, leads to regular en-eer's berth in new merchant ine. Full details on page 64

ntastic rubber takes steam and wer, and plenty of it. First blished data show typical ocess-power needs of new in-stry. Page 80

estions and answers on power gineering — Alex Higgin's dy course for operators who nt to do a better job and rn the "know-how" needed pass higher-grade license ms. Invaluable training for w men and a mighty good iew for the chief himself. st installment, page 114

ble of Contents—page 59

L&N Type P Combustion control installed on three 150 hp horizontal marine type stoker fired boilers. Panel is at right; note its compact arrangement, with the single Master Controller, three Furnace Pressure Controllers, and all Control Stations mounted on panel front. A typical easy-to-install Drive Unit, for uptake damper, is partially shown at left.

A Slogan For All A[MERICA]NS

ARMY NAVY

depends on me!

SOMETHING NEW

For The Boiler Room

The new L&N Type P Combustion Control is a dependable, sensitive equipment designed for plants which do not require the central-station type of control. It is ideal for small plants, and for many of the larger war plants. This Control has the flexibility of big-plant controls, yet is basically the same simple L&N Control used the world over on industrial furnaces. And its cost is minimized by using standard, industry-proved control units. Some of its features are:

Simple; Completely Electric. The feeding of both fuel and air to all boilers is regulated in response to a single Master Controller. This Controller is entirely electrical, and moves the dampers, valves and levers of the fuel-air system by means of electric-motored drive units. The only connection between drive unit and control panel is a single electrical conduit.

Low Cost of Installing. Elimination of compressors, piping and line shafting cuts the labor and time of installing; our factory-assembly of the control panel further reduces installation costs. We can, if desired, supply panel on either individual boiler or group panels. Frequently a boiler board, including both control and instruments, provides a most economical arrangement.

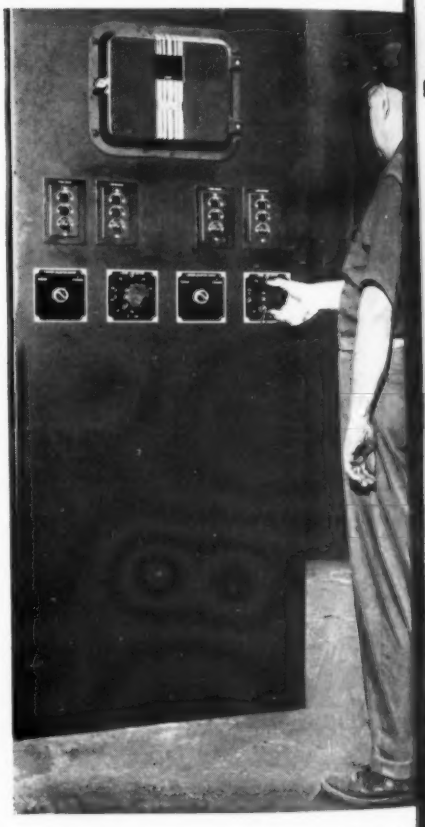
Flexible and Centralized. Without moving from the control panel, the operator can switch from fully-automatic control to base-load control or to push-button control; can operate some boilers on automatic control and some on push-button; can change fuel-air ratio of any boiler or boilers. In brief, he can suit the operation to the plant requirements.

Reliable. Control requires only electric power for its operation; which can come either from 110-volt a-c lighting circuit or from same circuit which supplies other boiler auxiliaries.

Furthermore, whether on automatic or remote push-button control, the motorized gear reducers cannot be back-driven by an unbalanced damper or equivalent.

Interlocks and other protective features are available.

A Catalog, now in preparation, will be sent when ready to all who request it. In the meantime, those who need information at once, in connection with a war production need, will be given specific facts promptly if they will outline their problems.



Standing at this simple Type P Control Panel for two oil-fired boilers, the operator is changing fuel-air ratio of one. Other switches enable him to operate on fully automatic control, base load control or push button control.

Jrl Ad N-01P-163(1)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

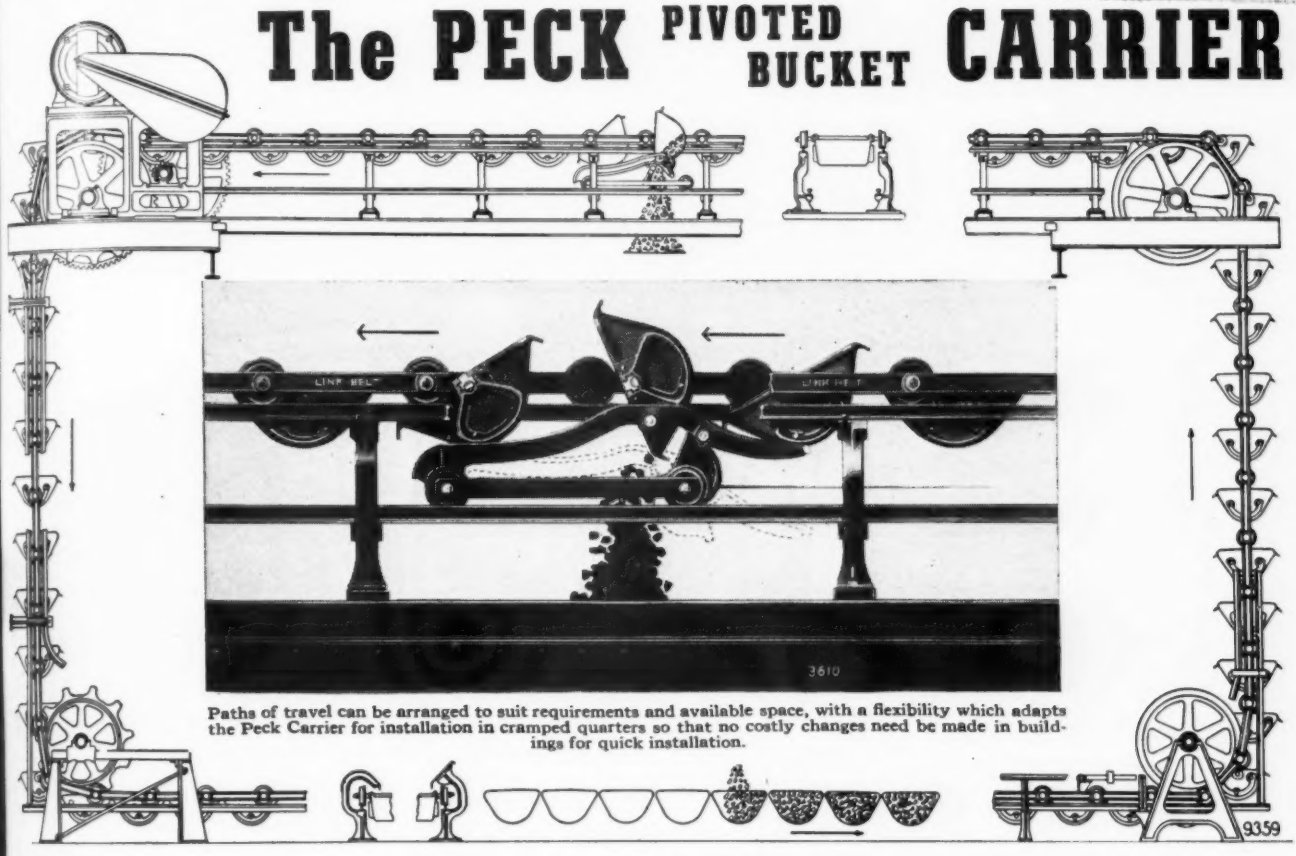
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"). March, 1943, Vol. 87, No. 3. Published monthly with an additional Directory number in December. Return postage guaranteed. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. EDITORIAL AND EXECUTIVE OFFICES, 330 WEST 42ND STREET, NEW YORK, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $.00 for two years, 35c per copy.

LIBRARY
DETROIT

Carry Coal In---Ashes Out With One Unit

The PECK PIVOTED BUCKET CARRIER



Paths of travel can be arranged to suit requirements and available space, with a flexibility which adapts the Peck Carrier for installation in cramped quarters so that no costly changes need be made in buildings for quick installation.

- Conserves Steel and Other Critical Materials
- Standarized Design
- Saves Power
- Saves Space

Today, with low cost production of power essential in our victory effort, we suggest you look into the advantages of the Peck Carrier. It offers a dependable handling method extremely low in upkeep and one that conserves critical materials. Practically no rolled steel and no rubber are used in its construction. It performs four functions—(a) elevates the coal (b) carries coal horizontally for distribution to bunkers (c) carries ashes horizontally away from ash pile (d) elevates ashes for disposition. It elevates and conveys in a continuous flow, without transfer points, vertically, horizontally, on an incline over any path of travel in a single vertical plane. Operation is quiet and, as it moves slowly, there is practically no vibration. Send for Book No. 1720.

- Low Upkeep
- Resists Corrosion
- High Capacity
- Handles Materials at High Temperatures

LINK-BELT COMPANY

9908

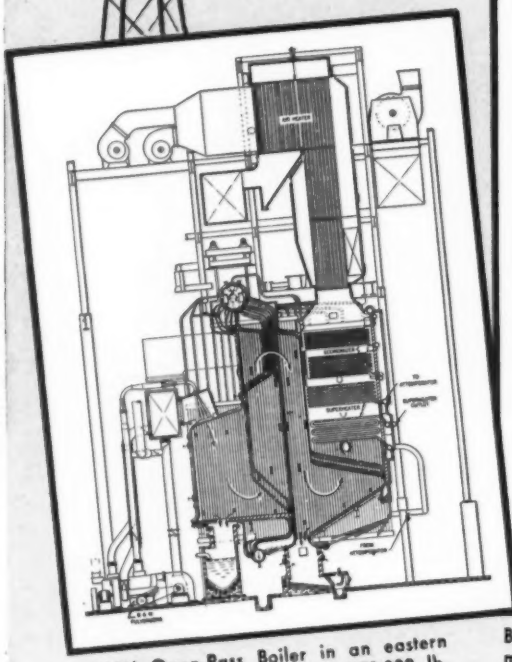
Chicago, Philadelphia, Indianapolis, Atlanta, Dallas, San Francisco, Toronto Offices, warehouses and distributors in principal cities

LINK-BELT

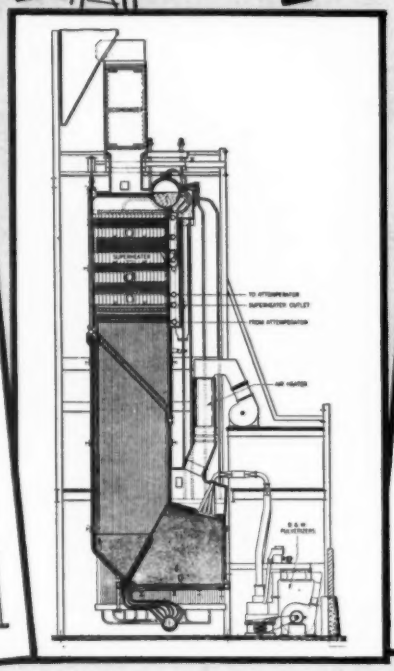
. . . Coal And Ashes Handling Equipment

CONVEYORS • ELEVATORS • SKIP HOISTS • CRUSHERS • LARRIES • SCREENS

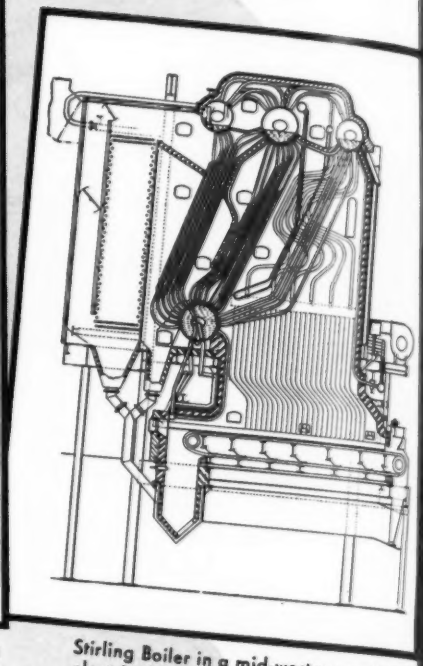
Helping



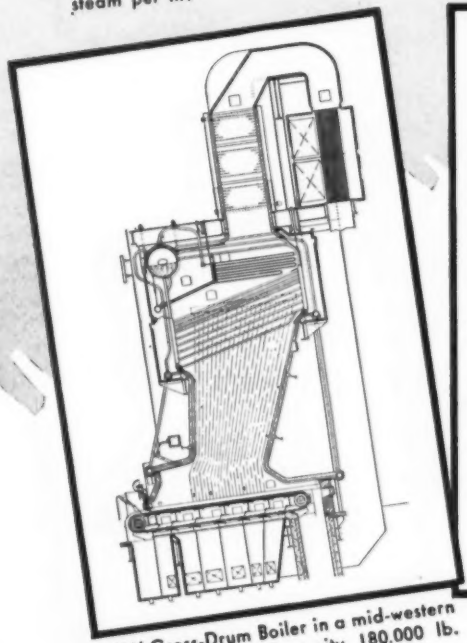
B&W Open-Pass Boiler in an eastern central station — Capacity 350,000 lb. steam per hr.



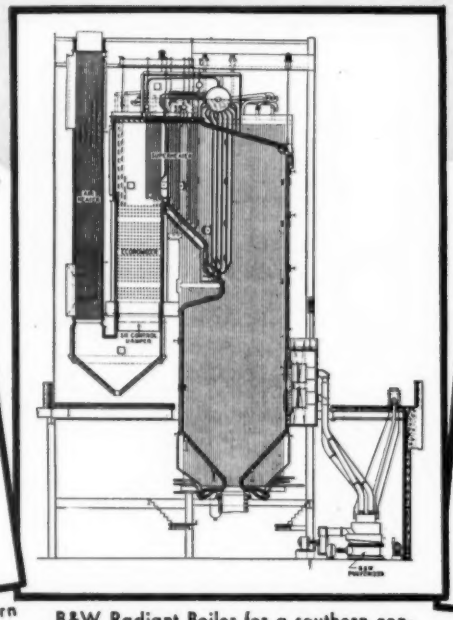
B&W High-Head Boiler in a mid-western municipal electric light plant—Capacity 300,000 lb. steam per hr.



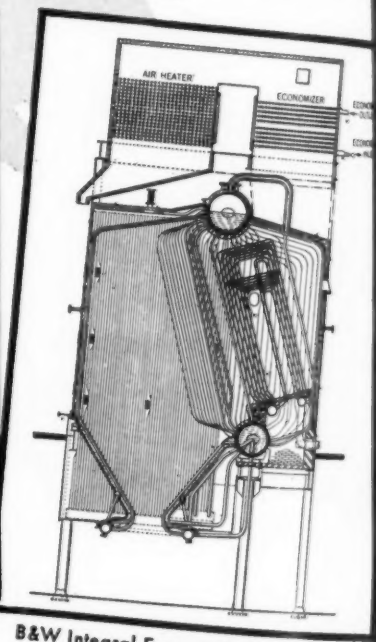
Stirling Boiler in a mid-western municipal electric light plant — Capacity 125,000 lb. steam per hr.



B&W Cross-Drum Boiler in a mid-western central station — Capacity 180,000 lb. steam per hr.

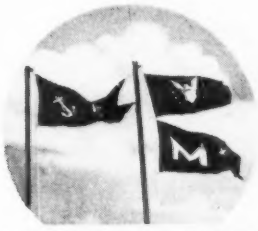


B&W Radiant Boiler for a southern central station—Capacity 400,000 lb. steam per hr.



B&W Integral-Furnace Boiler for an eastern central station — Capacity 150,000 lb. steam per hr.

Make Statistics



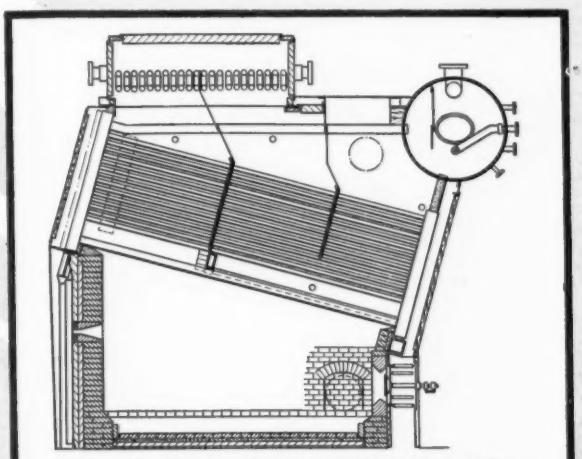
The Maritime Victory flag and "M" burgee now float proudly alongside the Navy "E" at the Barberton Works. Each is an award for "outstanding achievement" and is "an honor not lightly bestowed".

Statistical peaks in war-time power production have been made possible in no small degree by boilers built by B&W. The Open-Pass, Radiant, High-Head, and Integral-Furnace Boilers, the more recent of B&W's designs, have definitely established their ability to supply large blocks of power reliably. Standard B&W Cross-Drum and Stirling boilers need only passing mention as statistics makers—they have made records in their fields for many decades.

Noteworthy as is the production of steam for industrial power by B&W boilers, the records made in the marine field by other B&W boilers are equally impressive—whether in naval or other government service, or in the merchant marine. Statistics of ships placed in service might well be interpreted in terms of additional B&W boilers gone to sea, since B&W builds the greatest proportion of marine boilers. And one of B&W's designs was chosen by the Maritime Commission for all of its Liberty Ships, and all manufacturers of Liberty Ship boilers are working to B&W drawings.

So, whenever statistics on steam-power production appear, in the background are B&W boilers helping make the statistics possible. And, after the war, when materials for boilers for general service are again freely obtainable, B&W boilers with inherent richer experience will be available.

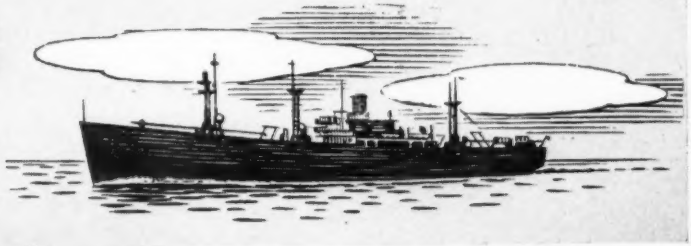
G-241T

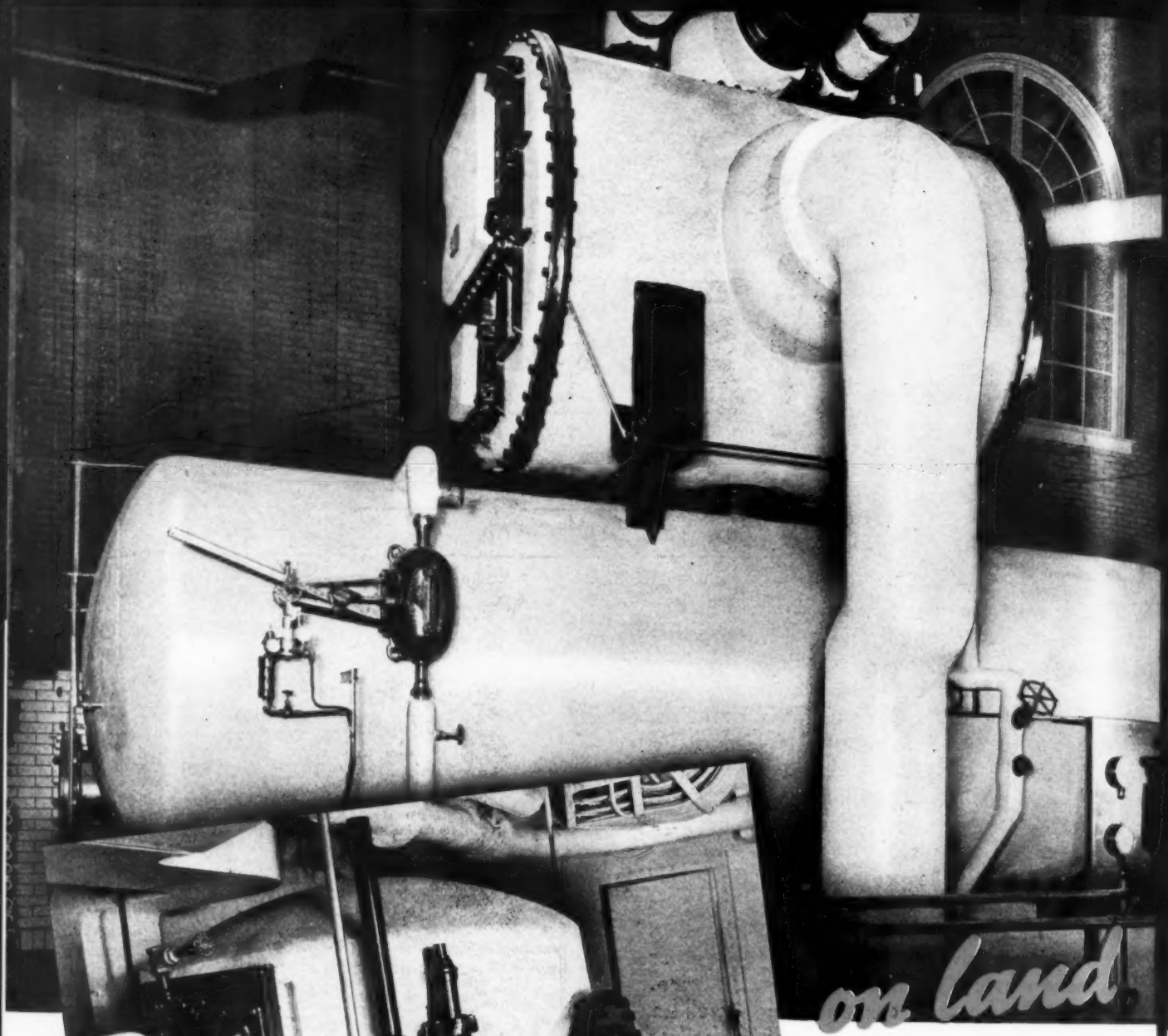


Sectional side elevation of the Liberty ship boiler

BABCOCK & WILCOX COMPANY

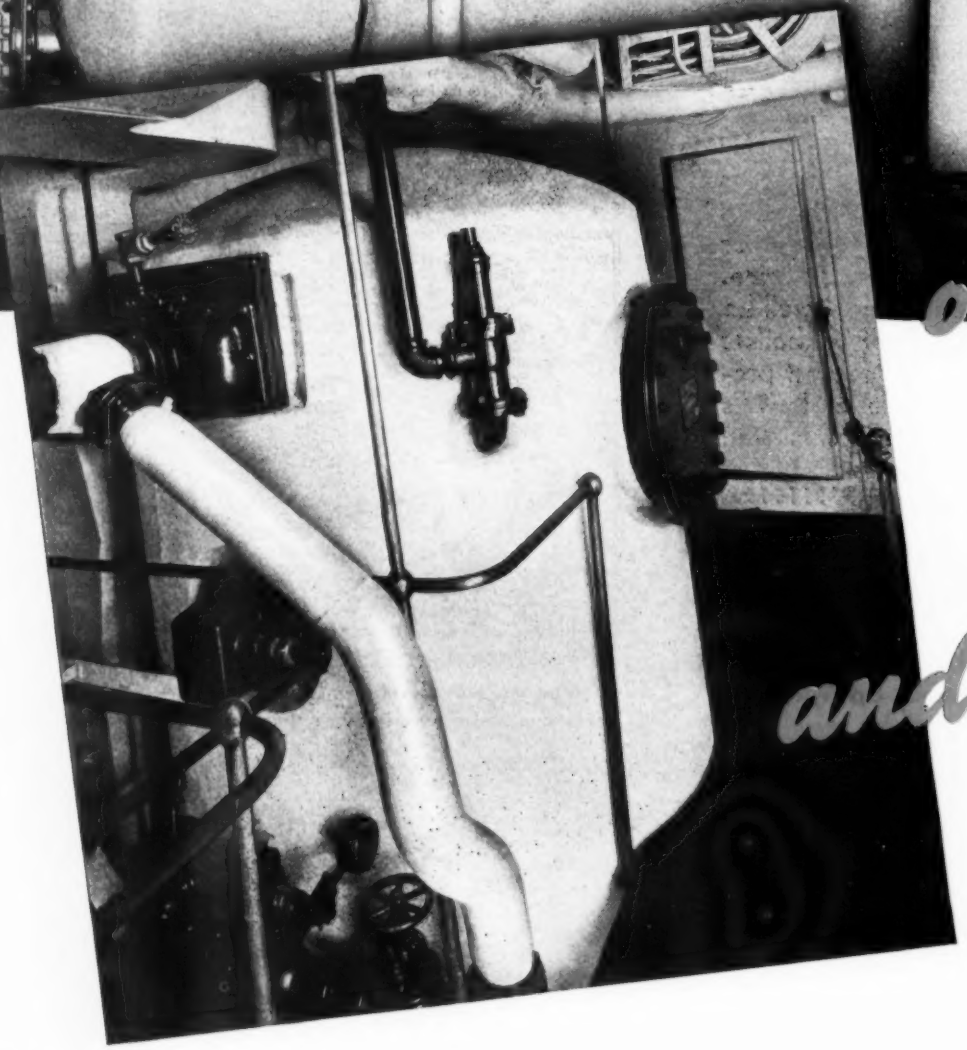
85 LIBERTY STREET, NEW YORK, N. Y.





on land

Above—*Elliott 453,100-lb.-per-hr. horizontal, cast iron deaerating feedwater heater mounted on a 6,000 gal. steel storage tank. This unit was built for a central station using materials most readily available at the time in order to make the quick shipment needed.*



and sea

At left—*Typical installation of an Elliott marine type deaerating feedwater heater. Hundreds of these units are today serving America's sea-going power plants. They are built to operate efficiently under the special conditions of marine service.*

ELLIOTT *pioneered* DEAERATION

Corrosion is an AXIS ally
– *defeat it with*

ELLIOTT

DEAERATING
FEEDWATER HEATERS

Twenty-three years ago Elliott engineers perfected the idea of removing dissolved oxygen from feedwater, thus defeating corrosion troubles in boilers, economizers, piping, etc. Deaeration has since become an accepted power plant principle and nearly all plants make provision for proper deaeration as a part of the feedwater heating cycle.

For service on land or on sea, the seasoned experience of Elliott engineers is helping designers select the proper type and size of deaerating unit, equipped with the desired water storage and controls, to fit into the heat balance scheme, and to meet any installation or space conditions.

If you have a problem of deaerating and heating feedwater, use the expert cooperation of Elliott engineers.

ELLIOTT COMPANY

DEAERATOR AND HEATER DEPARTMENT, **JEANNETTE, PA.**

DISTRICT OFFICES IN PRINCIPLE CITIES

N-873

nd is still breaking the trail

CAN YOU PUT

Your Finger

ON POTENTIAL TROUBLE SPOTS BEFORE THEY HAMPER PRODUCTION?

EVERY power plant or process is a chain of equipment elements in which some "weak link" may limit the capacity or its failure cause a shut-down of the entire plant. Can you put your finger on these potential trouble spots as they develop, before they get into the emergency class and disrupt production schedules?

Flow meters are bloodhounds for spotting faulty conditions as soon as they occur. An installation of boiler and distribution meters will enable you to track down these potential trouble spots long before they have a chance to become serious. This is of prime importance where the plant load is putting severe demands on both equipment and personnel.

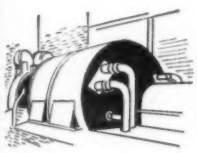
Power engineers in hundreds of industrial plants have found that the data made available by an intelligently engineered metering system has enabled them to increase the *de-*

EQUIPMENT • FACILITIES • PERSONNEL • EXPERIENCE
REPUBLIC INSTRUMENTS AND CONTROLS

pendable capacity of their plant by spotting and fixing weak links before they fail—and to increase the *effective capacity* of their plant by eliminating all unnecessary consumption of steam, water, compressed air, etc.
Here are a few typical examples:

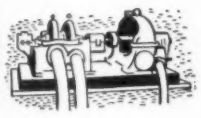
You can't improve conditions until you know what the conditions are.

TURBINE TROUBLES?

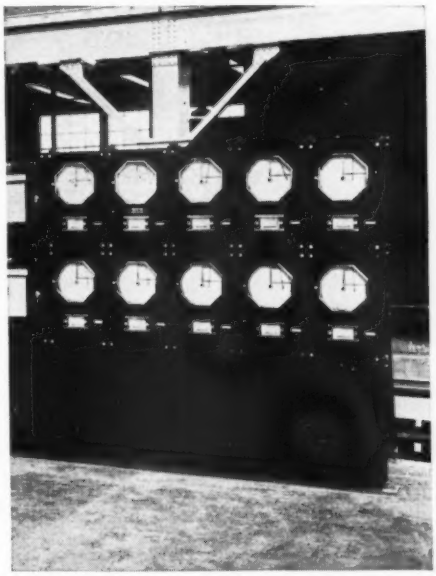


About a year after a turbine had been installed, difficulty was experienced in meeting the steam demand at certain times. Since this trouble had never arisen before, faulty operation of the turbine was suspected. Before deciding to overhaul the turbine, an expensive procedure, a Republic flow meter was installed on the turbine steam line. This meter instantly revealed that the turbine was operating within 2% of the performance guarantee and that the real trouble was in the steam generating plant. Here it was found that two of the units were delivering only 60% of their rated output. The data provided by the flow meter prevented an unnecessary turbine overhauling and placed the blame where it belonged.

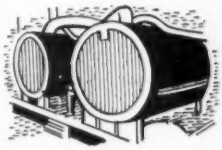
PUMP TROUBLES?



When a battery of six process water pumps failed to operate at full capacity it was necessary to dismantle them one by one to locate the trouble. This procedure required two weeks to find out what an installation of flow meters could have revealed in two seconds. Of course, there was only one answer—Republic meters now measure the discharge from each pump.



EFFECTIVE CAPACITY?
By studying steam and water flow meter records, a process plant found it possible to shut down a triple-effect evaporator completely and draw liquor of the same strength from an intermediate stage of a quadruple-effect evaporator. This change saved approximately 100,000 lb. of steam per day. Thus the effective capacity of the boiler plant was increased by this amount.



Hundreds of similar experiences recorded in our files provide overwhelming evidence of the value of Republic meters.

A COMPLETE METERING SERVICE
The Republic Flow Meters Co. offers nationwide evidence of the preference shown by industrial leaders for Republic flow meters. Whether it be in the steel industry, paper industry, chemical industry or other major industries, you will find an impressive number of Republic flow meters measuring the distribution of steam, water, gas and air.

What does this leadership mean to you? Briefly, this: when you decide—as you eventually will—to take full advantage of the assistance modern instruments can render, a statement of your aims to Republic will make available an unmatched experience, a complete range of instruments and alternative schemes to choose from. One of our engineers will be glad to call at your request, without any obligations on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

ARSENAL INSTALLED A·
...MORE POWER TO TH

PROBLEM:

In 1937 and again in 1939, a large arsenal located in Eastern United States faced the problem of installing fuel firing equipment most suitable to their current as well as future emergency needs—needs of peacetime, war preparation, or all-out war production. Reliability was paramount. The nature of the operations required wide steaming fluctuation—with great variation in the quantity of steam demand. Capacity must be sufficient to maintain operation while boilers were out for inspection, or in case of failure of a unit it must be prepared to go on 24 hour duty. And because of location, it must discharge a minimum of fly ash.

SOLUTION:

In each year, A-E-CO Taylor Stokers were purchased by the arsenal. Two were installed in 1937; another two in 1939. All four A-E-CO Taylor Stokers are 7 retort, 37 tuyere, continuous ash discharge type, driven by steam turbines.

RESULTS:

In a subsequent report on operating performance, covering precisely one year, the arsenal generated 547,651,000 lbs. steam, burning 55,949,000 lbs. coal (Average evaporation 9.8 lbs. steam/lb. coal). Operating conditions: 450 lbs. pressure, gauge; 620°F. steam temperature; and 215°F. feed water temperature to boiler. The combined efficiency was 79.1% *without* the use of any heat recovery equipment. There have been no complaints about stack discharge although the arsenal now works 24 hours a day.

CONCLUSION:

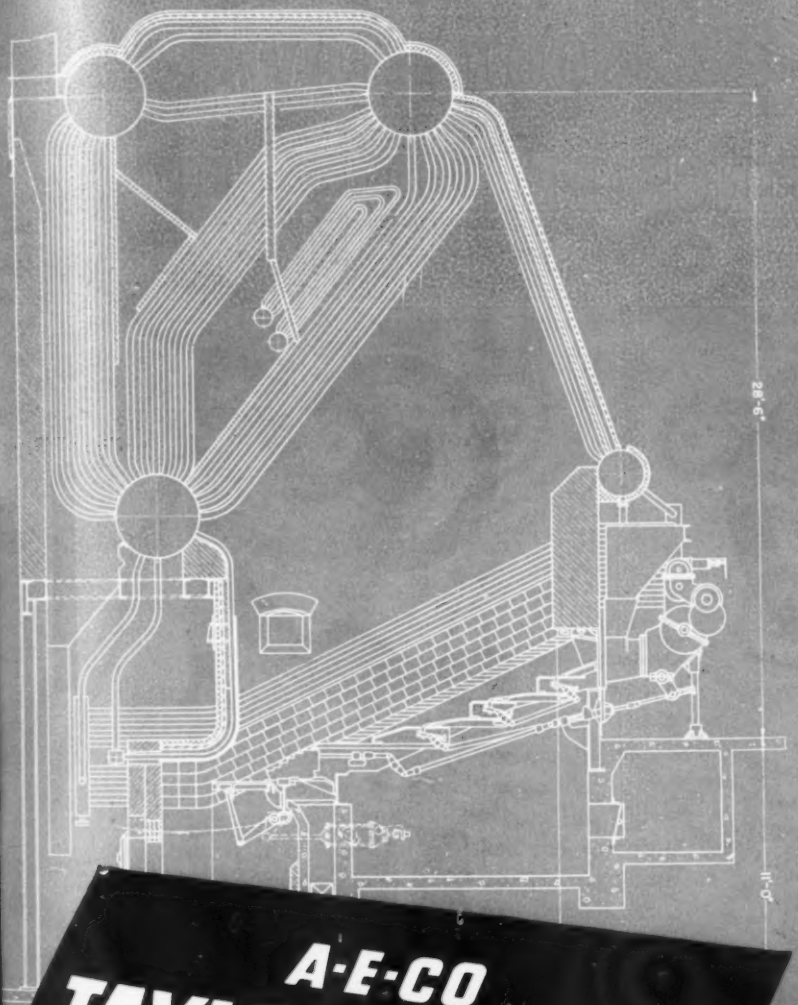
When there is any possibility that steam demands may be suddenly varied without warning—and remain under changed conditions indefinitely—when stack discharge is a matter of concern to your community, when reliability, capacity, and wide steaming fluctuations may have to be met, look carefully into the advantages of A-E-CO Taylor Stokers before you make your choice.

A CASE IN THE GOVERNMENT PLANT FIELD

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA

A-E-CO TAYLOR STOKERS
THE WAR EFFORT



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America #1
*Aluminum Company of America #2
American Tobacco Co., Inc., Durham, N. C.
Castanea Paper Company
Chrysler Corporation, DeSoto Plant
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co.
*Detroit Sulphite Pulp & Paper Co.
City of Dover, Ohio
*Draper Corporation
Erwin Cotton Mills Co.
*Fisher Body Corporation #1
Fisher Body Corporation #2
*Fisher Body Corporation #3
*Fisher Body Corporation #4
Fox Paper Company
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company
*General Electric Company #1
*General Electric Company #2
*Greenwood Electric L. & W. Plant
*Board Public Works, Hannibal, Mo
Hill School, Pottstown, Penna.
*Hobart Mfg. Co.
*City of Holland, Michigan
*Hope Natural Gas Co.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills
*Packard Motor Car Co.
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge
*Pennsylvania Electric Co.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Pittsburgh Plate Glass Co.
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company
Shelby Cotton Mills
Sloane-Blabon Corp.
*Solvay Process Company
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co. #1
Timken Roller Bearing Co. #2
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co.
Whiting Plover Paper Company

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

A-E-CO TAYLOR STOKERS
WATER WALLS·ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

COMPANY (AE CO)

ARE YOU JUDGING YOUR STOKER BY THESE TWELVE POINTS?

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

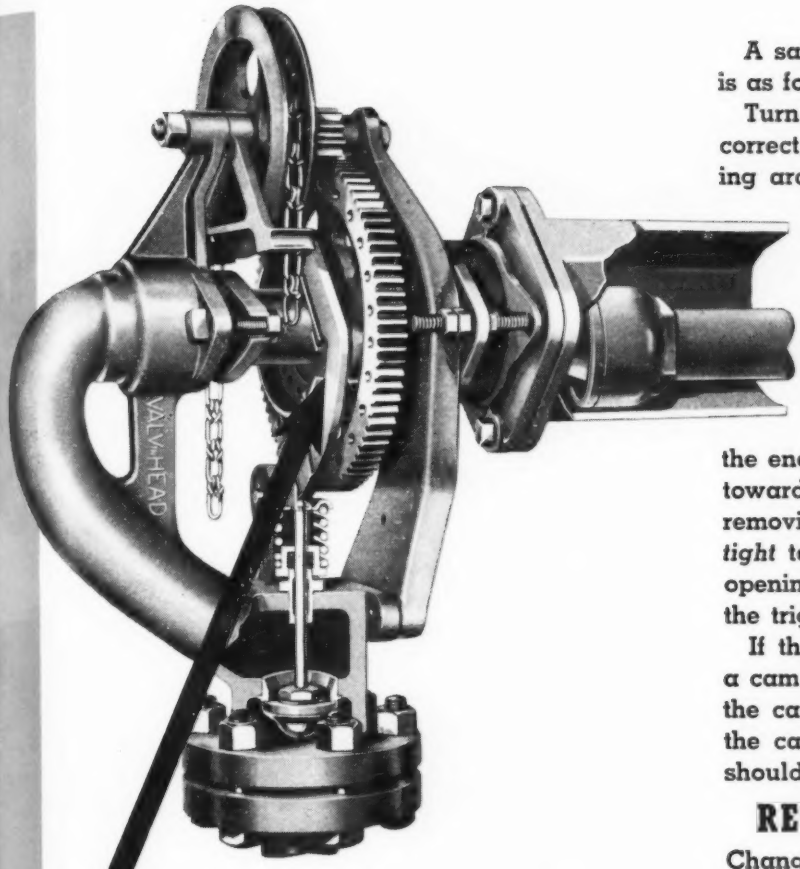
FOR BETTER BOILER CLEANING

Check SOOT BLOWER CAM SETTINGS PERIODICALLY

Position of cam and trigger of Diamond G9B Soot Blower just prior to beginning of blowing. Clockwise rotation of the cam will depress the trigger and open the valve.

Trigger is now completely depressed and valve is open. Length of cam determines blowing arc as valve remains open until trigger slips off other end of cam.

THROW YOUR *Scrap* INTO THE FIGHT



A MOST IMPORTANT PART of the Diamond G9B Soot Blower is the cam which opens and closes the valve—and which regulates the pressure where reduced pressure blowing is employed.

In any case, the cam determines the blowing arc. If it is not properly set, the blowing arc will be wrong. If the arc is too long, steam is wasted, and tubes, headers, baffles, etc., may be injured. If the arc is too short, effective cleaning is impossible.

Cams on all G9B heads should be examined periodically for tightness and correct position. Drawings furnished for installation of Diamond Soot Blowers show the correct blowing range for each unit. It is important that nozzles should not blow directly into boiler headers, drums, baffles, etc., at close range with full pressure.

A safe method for checking or setting cams is as follows:

Turn the element so that the nozzles are in correct position for the beginning of the blowing arc. With the head in this position, place the opening end of the cam (the beveled end with the slot in it) in contact with the end of the trigger. Then attach the cam to the gear wheel by means of two cam bolts made up handtight, and turn the head until the nozzles are in correct position for the end of the blowing arc. Mark the cam directly at the end of the trigger, and cut it off 2¼" back toward the beveled end from this point after removing it from the gear wheel. Then bolt *tight* to the gear wheel, making sure that the opening end of the cam comes in contact with the trigger first.

If the blowing arc is so short as to require a cam 3" long or less, cut off only the face of the cam and leave at least five bolt holes in the cam flange. Not less than two cam bolts should be used.

REDUCED PRESSURE BLOWING

Changes in baffles, etc., may require reduced pressure blowing through part of the arc. Special cams should be used to provide any needed sequence of reduced and full pressure blowing.

360° ARC BLOWING

Some conditions require a unit to blow through the entire revolution. In such cases, 360° cams and triggers should be used.

GET ***MORE*** OUT OF THE SOOT BLOWERS YOU HAVE

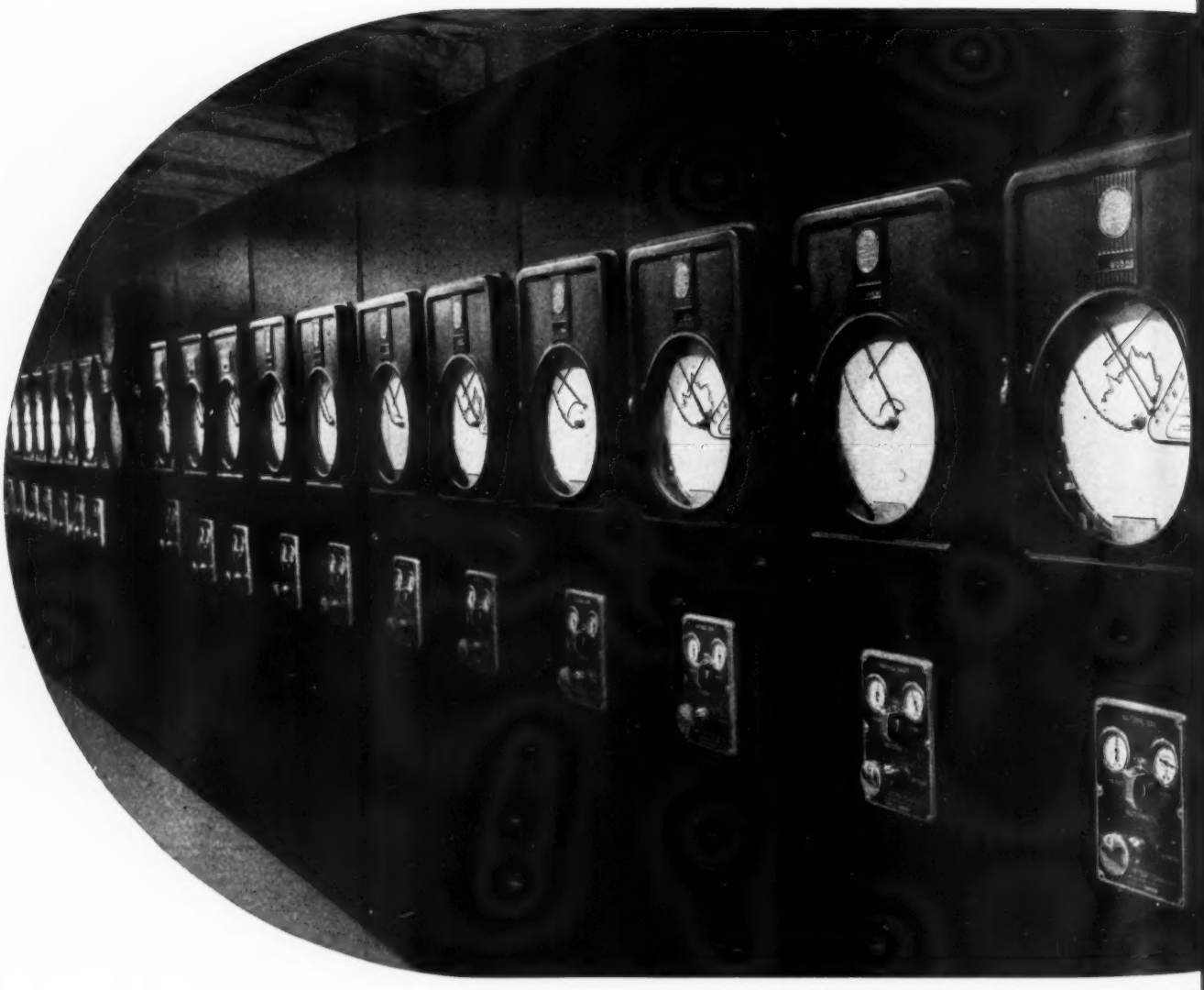
War demands often make it difficult for us to supply new blowers or repair parts as promptly as we'd like. Careful maintenance will prolong the useful life of the blowers you have. This booklet tells you how to maintain, adjust and repair Diamond G9B Soot Blowers. *Write for a copy.*

DIAMOND POWER SPECIALTY CORP.

DETROIT • MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

FULL CAPACITY



Bailey Meter Control installed on gas-fired boilers in a Steel Mill Power H

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERH

WITHOUT WASTE OR OUTAGE

Bailey Boiler Control Insures Safe Economical Operation At High Rates of Steaming

★ Full capacity is obtained from a steam generating unit only when the many factors which enter into its operation and control are carefully coordinated and accurately maintained at their optimum values.

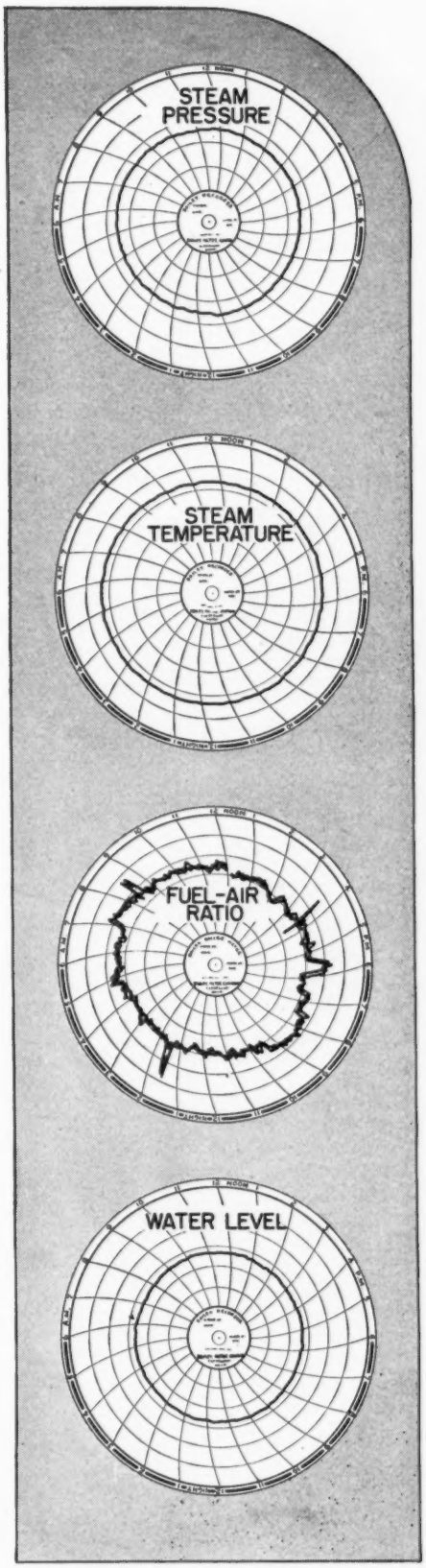
Care must be taken in approaching these optimum values since serious waste and danger of breakdown is likely to occur unless dependable measurements of the factors are made and continuous vigilance is exercised in their control.

Blind efforts to increase boiler capacities by raising combustion efficiency may result in waste of fuel and in serious damage to boiler furnaces.

High capacities may be safely and economically attained with the help of Bailey Boiler Control which continuously maintains the following factors at their optimum value:

1. Steam pressure; to provide maximum turbine efficiency and to prevent waste through safety valves.
2. Steam temperature; to provide maximum turbine efficiency and to prevent damage resulting from excessive temperatures.
3. Fuel—Air Ratio; to keep to a minimum the volume of gases which must be moved through the boiler per unit of heat release, and to reduce excess air loss to a minimum without decreasing fuel economy or damaging furnace refractories.
4. Feed water flow and level; to maintain a uniform heat demand and to avoid both "high" and "low" drum level.

Bailey Meter Control serves the war effort by making it possible for power engineers to carry on with safety and economy at full capacity in spite of wartime scarcities. A-88



BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

TEAM FOR A LEISURELY AFTERNOON

What a team they make — the American Ranger and the diesel engine in his landing barge!

Leisurely afternoon? Well, we don't mean *this* afternoon. Right now, there are tough hours and days ahead for them both.

We mean some afternoon in the future, when all the barges have landed, when all the beach-heads are mopped up, an afternoon when the guns are silenced and the Ranger and his diesel are back at their peacetime jobs again.

When that day comes, this man who is now a Ranger will enjoy new leisure. The engine will be shouldering more of his loads. Giving him better light, or transportation. Working long *engine-weeks*, so that he may work shorter *man-weeks*.

That's a post-war aim worth the best we've got to make it come true. It's worth our nights, and week-ends and holidays. We give them gladly. Rogers Diesel and Aircraft Corporation, 1120 Leggett Avenue, New York, N.Y. *Divisions:* Hill Diesel Engine Company, The Edwards Company.

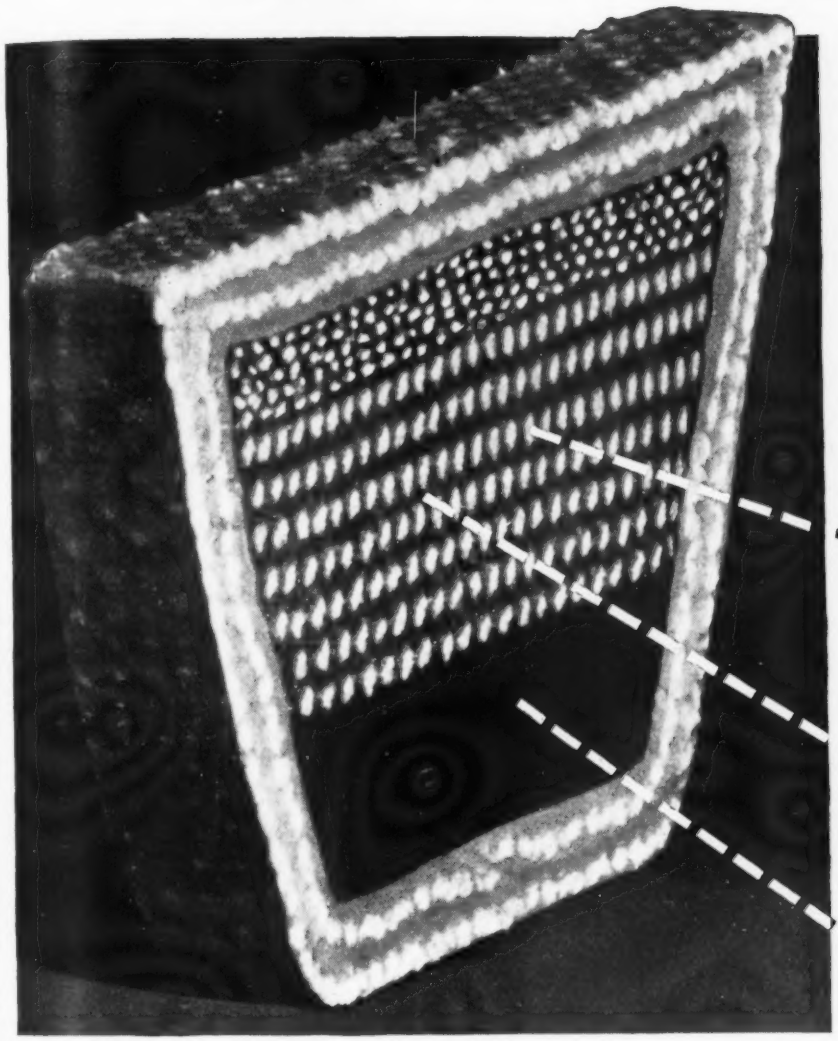
ROGERS

R D A

DIESEL AND AIRCRAFT CORPORATION

Diesel Engines, 5 to 2000 h.p. » Gasoline Engines » Generator Sets » Generators » Power Units » Switchboards » Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms » Power Mowers » Power Brushes » Snow Removal Equipment Streamlined deluxe Railway Motor Trains » Diesel Locomotives

Here's a Slice of LONGER V-BELT Life!



It's the section of a new Texrope Super-7 . . . and the new ways Longer Life is Built right into it Point to ways *You* can make Your V-belts last Longer.. whatever Brand you Use!

V-Day needs every V-Belt

50% STRONGER CORDS produced by the new Flexon process combat stretching. **YOU** can fight stretching—and the slip and burning that result — by promptly taking up any slack that may develop. Remember, many V-belts are now working four times as many hours a week as in peacetime, may need inspection *four times as often!*

★

20% MORE CORDS than before help protect the new Texrope Super-7 against strains and breaks. **YOU** can minimize breaks in your plant — whatever make of V-belts you use — by requiring that V-belts *never* be pried into grooves. For V-belts, prying is a back-breaking operation!

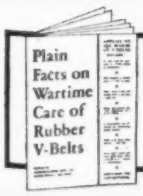
★

COOLER-RUNNING CUSHION of special rubber "eases" cords around sheaves—for smoother flexing and less heat. **YOU** can fight heat by preventing misalignment. It causes rubbing of belt sides, extra heat and shorter V-belt life. So keep sheave grooves in line—shafts parallel.

★

WHEN YOU DO NEED new V-belts, *invest in the best* — Texrope Super-7!

A 1543-A



FREE! Every engineer should have this valuable new handbook in his technical library.

It applies to *all* makes of V-Belts—contains no advertising. Write Allis-Chalmers for it *now!*

ALLIS-CHALMERS

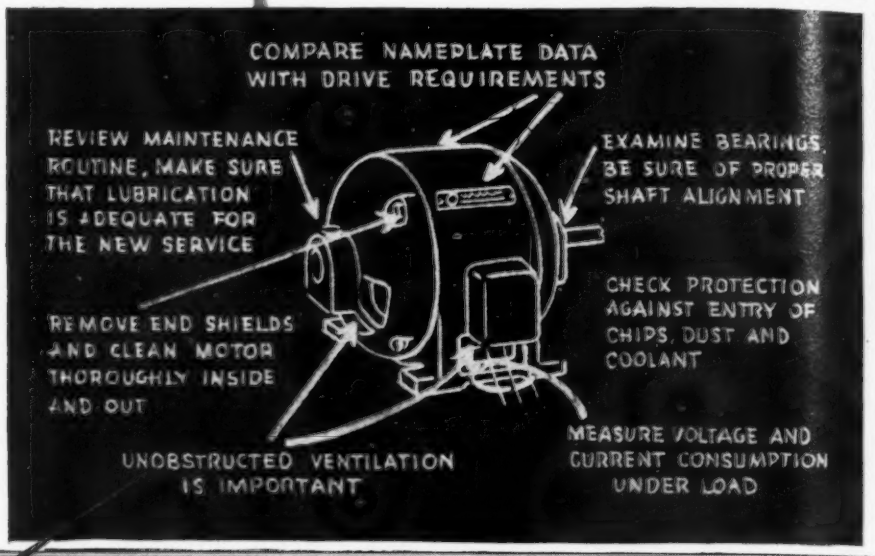
TEXROPE* SUPER-7 V-BELTS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

*Trade mark registered U.S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

MOTOR CARE

IT'S TIME TO BE A CRANK ABOUT


COMPARE NAMEPLATE DATA WITH DRIVE REQUIREMENTS
REVIEW MAINTENANCE ROUTINE, MAKE SURE THAT LUBRICATION IS ADEQUATE FOR THE NEW SERVICE
EXAMINE BEARINGS, BE SURE OF PROPER SHAFT ALIGNMENT
CHECK PROTECTION AGAINST ENTRY OF CHIPS, DUST AND COOLANT
REMOVE END SHIELDS AND CLEAN MOTOR THOROUGHLY INSIDE AND OUT
UNOBSTRUCTED VENTILATION IS IMPORTANT
MEASURE VOLTAGE AND CURRENT CONSUMPTION UNDER LOAD

protect your production with this maintenance plan

Planned motor maintenance, keyed to today's loads and conditions, saves vital hours by forestalling future breakdowns and delay. In replacing hit-or-miss motor service with a regular schedule of trouble-*prevention*, you'll find real help in the new G-E publication, "How to Care for Motors."

The check list (right) tells what to do. This book tells how to do it, using well-proved methods that save time and help assure long-lasting motor service.

And, of course, your local G-E Motor Representative is always ready to aid you in putting these suggestions into practice, or in getting the new motors you may need for essential wartime projects.

1. Make sure that motors are selected to *match the job*. Install motors so they are properly aligned with the driven load and are easily accessible for regular inspection.

See "How to Care for Motors"

2. Keep motors free from dust and dirt. Establish a definite cleaning schedule.

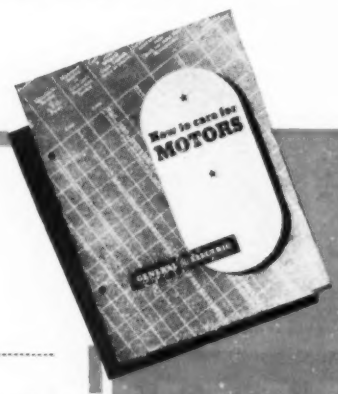
See "How to Care for Motors"

3. Be sure that lubrication is frequent enough to take care of increased production. See that employees are instructed as to proper methods.

See "How to Care for Motors"

4. A general overhauling of hard-worked motors will add years to their life. If your motors haven't had an overhaul in the last year, try to arrange your schedule to permit one.

See "How to Care for Motors"



HOW TO CARE FOR MOTORS

Every supervisor and maintenance man will find this book of value . . . it tells what to do to get the most out of motors, old or new. If you're setting up a maintenance program to keep up with today's unprecedented demands, or if you're "switching" motors from one job to another, or equipping machines with new motors, you'll find this booklet of helpful motor facts will save you time. Write for a copy.

General Electric; Sec. PO 750-179C
Schenectady, N. Y.

Yes, send me a copy of "How to Care for Motors," GEA-2856A.

Name.....

Title.....

Company.....

Address.....

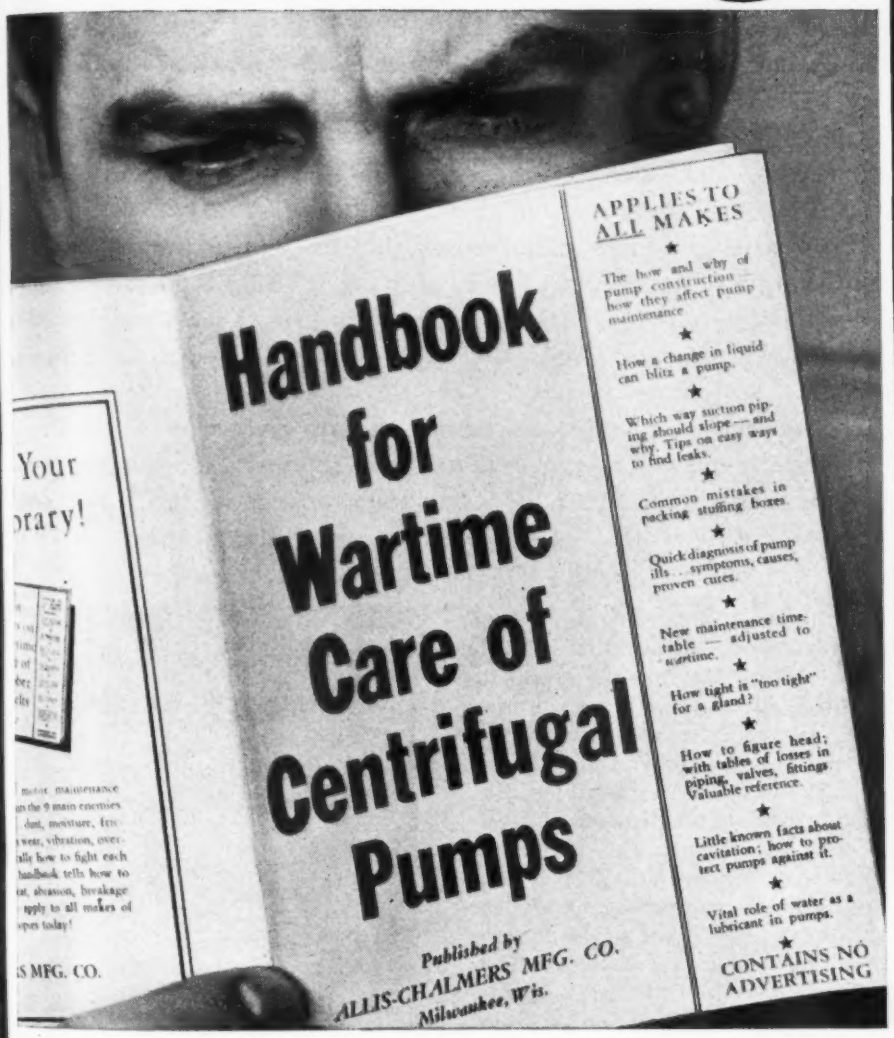
City.....State.....

3080

BUILDER OF TRI-CLAD MOTORS

GENERAL ELECTRIC

Required Reading!


Handbook for Wartime Care of Centrifugal Pumps
APPLIES TO ALL MAKES
The how and why of pump construction — how they affect pump maintenance
How a change in liquid can blitz a pump.
Which way suction piping should slope — and why. Tips on easy ways to find leaks.
Common mistakes in packing stuffing boxes.
Quick diagnosis of pump ills . . . symptoms, causes, proven cures.
New maintenance timetable — adjusted to wartime.
How tight is "too tight" for a gland?
How to figure head; with tables of losses in piping, valves, fittings. Valuable reference.
Little known facts about cavitation; how to protect pumps against it.
Vital role of water as a lubricant in pumps.
CONTAINS NO ADVERTISING
Published by ALLIS-CHALMERS MFG. CO. Milwaukee, Wis.

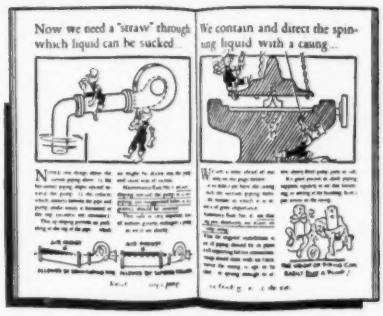
Your copy is free! Allis-Chalmers will gladly mail copies of "Handbook for Wartime Care of Centrifugal Pumps" *free of charge*. It applies to *all* makes — contains no advertising. Use it to make present pumps last — and when you *do* need new pumps, look into the extra efficiency and long life built into Allis-Chalmers centrifugal pumps . . . all types for every purpose.

ALLIS-CHALMERS
MILWAUKEE

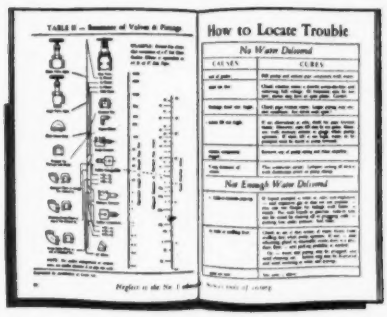
WE WORK FOR VICTORY — WE PLAN FOR PEACE

PUMPS NOW DO 4 TIMES THEIR NORMAL WORK - NEED THE FINER KIND OF CARE SET FORTH IN ALLIS-CHALMERS' NEW HANDBOOK!

EVERY EXECUTIVE, engineer and operating man should have a copy of this important new publication in his technical library. Pumps doing wartime work (8700 instead of 1800 hours a year) need *wartime care!*



To make principles of pump maintenance crystal-clear a pump is *built!*



Contents include valuable tables of friction losses, a guide to locating trouble, a maintenance timetable geared to *wartime!* Get *your* copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

(Street Address)

A 1583 A (City and State)

Conserving Manpower

with Reliance EYE-HYE

Save thousands of steps . . . get better supervision . . . with this Remote Reading Water Level Gage

With manpower scarce, the problem of keeping close watch on scattered water gages can be a serious worry. Yet you can't afford to slight such an important job, on which often hangs efficient steaming and avoidance of costly repairs. EYE-HYE gives you *water gage accessibility* — either centralized supervision or at least conveniently located, easily reached gages for main boilers, waste heat boilers, heater tanks, and other vessels.

Whether boilers or tanks are above or below your operating floor, EYE-HYE delivers water level readings where you want them — accurately, dependably and with a big saving of steps. It works just as well "upstairs" as "downstairs," as explained on the opposite page.

In operation, the EYE-HYE is simple and free from mechanical troubles. It's a gage that reads easily, quickly — the green indicating fluid, illuminated from the rear, supplying a sharp though not glaring impression on the eyes. Connections between vessel and EYE-HYE are two flexible tubes, more readily placed than pipes and following any convenient route. EYE-HYE models are available for any liquid level variation up to 48 inches. Graduated scales are supplied where desired, for actual content reading of tanks. Write for Bulletin 382-C to The Reliance Gauge Column Company, 5902 Carnegie Avenue, Cleveland, Ohio.

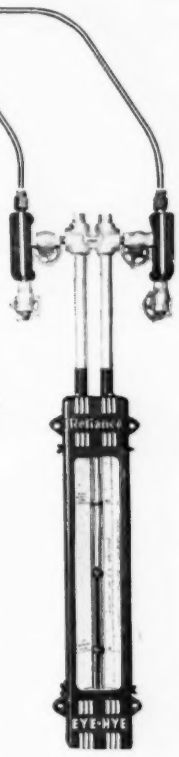
Since 1884

Reliance

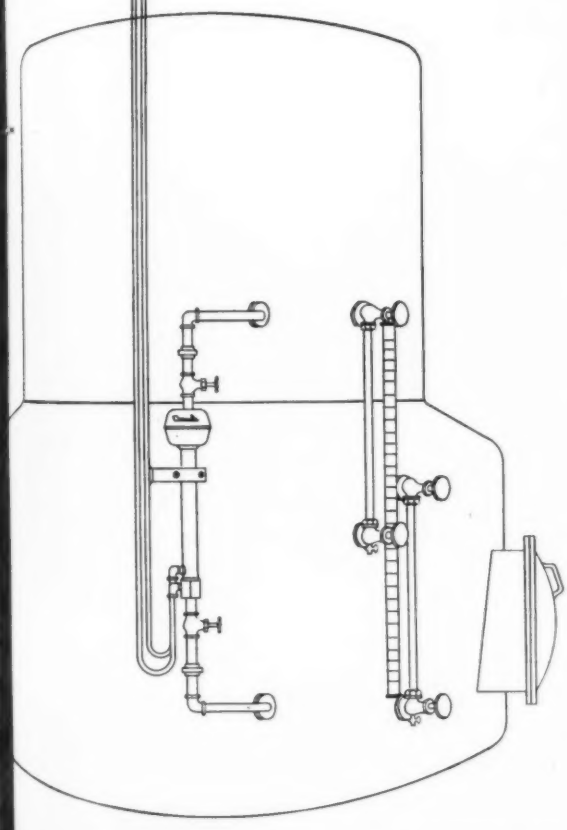
BOILER SAFETY DEVICES

Here's how EYE-HYE works "upstairs"

The Reliance EYE-HYE operates on the fundamental U tube manometer principle, the special indicating fluid, VIZZENE, counterbalancing differences in hydrostatic pressure imposed through connecting tubing from the drum or vessel to which the EYE-HYE is attached. One tube carries a constant pressure by reason of a controlled constant head of water maintained in a reservoir. The other tube carries a variable pressure dependent on actual height of water in the vessel being measured. The VIZZENE translates the pressure differential, and shows the actual height of boiler water in the calibrated EYE-HYE window.



The foregoing simple statement of operation is true whether EYE-HYE is mounted *below* or *above* the actual water level being measured. In either case, all hydrostatic force is exerted downward and, up to the actual range of water being measured, the weight of water in the intermediate tubing has no bearing on the VIZZENE reading because equal forces balance each other.



When EYE-HYE is mounted above the water level being measured the elevation is limited by the force of atmospheric pressure. At sea level, the approximate 15 pounds atmospheric pressure will support an approximate 34 foot column of water. To offset variables such as a possibility of partial vacuum within the vessel, we suggest a maximum EYE-HYE elevation of 25 feet.

The only difference in hook-up of EYE-HYE for operation *above* the vessel as opposed to the more usual position *below* the water to be measured, is that downward loops are formed in the two lines of tubing before they connect to the vessel, as shown in the illustration. If the connecting tubing were attached directly from vertical run to vessel, air bubbles would eventually travel up the tubing, breaking the vacuum seal and allowing the water to drain, thus destroying the reading of the EYE-HYE.

THE RELIANCE GAUGE COLUMN COMPANY • CLEVELAND

"IF THE WAR ENDS THIS YEAR, OR NEXT, WILL WE BE READY TO MEET THE NEW CONDITIONS?"

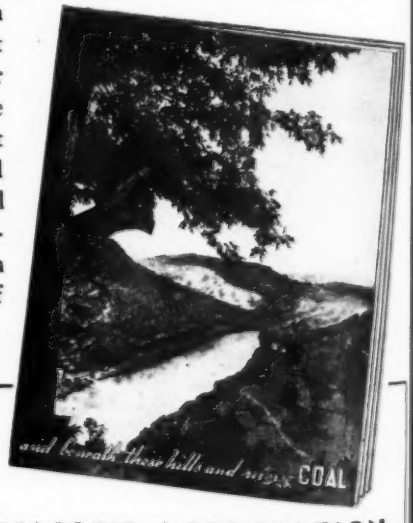
Kaufmann-Fabry Photo

Post-war competition will be keen. The plants which excel will be those which plan now to take advantage of savings which can be effected through modernization of coal burning equipment.

● Fuel costs materially affect the cost of the final product in most industrial and utility plants. Post-war competition will be extremely keen in the industrial field. If the product you endeavor to market after the war is burdened with an item of excessive fuel costs, your company will be in a vulnerable position. If your old and new competitors have low fuel costs, they will enjoy a distinct advantage. Holding manufacturing and fuel costs to a minimum will then become a matter of vital importance and will frequently mark the difference between solvency and insolvency of a business.

If your plant has obsolete and unsuitable burning equipment which prohibits the use of the greatest value-giving coals, you should make plans *now* to modernize. Equipment manufacturers are now beginning to put their houses in order to handle plant modernization programs, so it is not too early to contact consulting engineers and manufacturers of stokers, pulverizers, furnaces and boilers, and plan to modernize your plant so as to permit the use of coals which produce the lowest overall steam costs.

Consideration should be given to the fact that the preponderance of steam coals available today fall in the low fusion ash bracket, and that because of their abundance these offer the greatest fuel values. Good engineering and design insure complete satisfaction in the burning of these coals.



PICK FUEL FOR THE FUTURE AND FOR TODAY

Request a copy of the Brochure—Coal—which describes the Pittsburgh, the greatest coal seam in West Virginia, the Number One producing state.

COAL BUREAU, UPPER MONONGAHELA VALLEY ASSOCIATION
FAIRMONT, WEST VIRGINIA

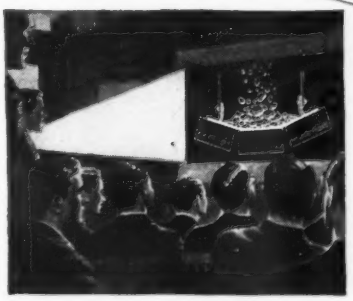
17,485

PLANT AND FIELD OPERATING MEN USE THIS MANUAL

Send for your FREE copy

YOU can get far longer life from your precious belting, hose and other rubber products by following the conservation practices recommended in this authoritative manual, prepared by the G.T.M. – Goodyear Technical Man.

More than seventeen thousand field and factory maintenance men are now using it, after seeing its rubber-saving helps demonstrated in the interesting slide film "GOODYEAR WAGES WAR ON WASTE." To have this important film shown to a group meeting at your offices, and to obtain copies of the manual for your key operating men, write Goodyear, Akron, Ohio or Los Angeles, California – or phone the nearest Goodyear Mechanical Rubber Goods Distributor. Remember many rubber products cannot be replaced – the Goodyear conservation plan will help you save them!



SEE HOW TO GET UP TO 50% LONGER WEAR FROM BELTS AND HOSE — *it's clearly shown in the slide film "Goodyear Wages War on Waste" — with complete instructions in the Goodyear Manual.*

GOODYEAR

THE GREATEST NAME IN RUBBER

10 Ways YOU and WE Can Help Speed Victory

A Mid-West metal distributor received an urgent call from an airplane instrument manufacturer. Unless 125 feet of "R" Monel could be delivered immediately, production of a vital part would be held up. The required metal was delivered from stock the same day. Production continued at top speed.

Additional footage was also supplied to keep the manufacturer going until his mill shipment arrived.

At nine o'clock on a Sunday evening, an Army officer drove to a distributor's office for a rush order of metal to go with a convoy sailing at dawn. The night watchman phoned warehouse employees. The order was filled on time for the convoy's sailing.

★

With all metals and alloys on the critical list, distributor stocks have assumed new importance . . . providing a country-wide pool of materials. Many examples . . . beside the two above . . . could be cited.

Less dramatic . . . but equally important . . . is the day-to-day service provided by INCO distributors. Maintaining complete and up-to-date information about Government orders and regulations saves time and trouble for metal users.

Distributors acquire broad experience in many industries...and familiarity with the fund of technical information made available by the engineering and research staffs of The International Nickel Company. Thus they are equipped to advise about proper uses of metals and alloys...and often help users overcome production difficulties.

What YOU can do:

1 Conform with WPB regulations. New regulations are being issued constantly.

2 Place your orders as early as possible.

3 Indicate alternate choices on sizes and materials ...where possible. By so doing a satisfactory alternate may be obtained immediately. Otherwise considerable time may be required to obtain the exact size or material indicated.

4 Don't hesitate to ask technical questions about selection, uses and working of Nickel, Monel and other critical metals. We can often offer suggestions which reduce shop spoilage...and *save metal.*

5 Depend upon us—your metal distributor—for as much shop service as possible. Use our facilities to cut down the number of operations in your plant.

What WE can do:

1 Advise on WPB requirements. Special departments keep fully informed on Government regulations. Help metal users solve priority problems.

2 Help *new* users of Monel, Nickel, Inconel and other special alloys. We offer practical advice on welding, machining, heat treating and other processing methods.

3 Special sizes and shapes in stock. Stocks maintained complete as possible under wartime conditions. By suggesting alternate sizes or materials, we often keep production moving.

4 Special services...such as cutting, shearing or sawing to size...help overloaded plant facilities. Delivery as needed keeps metal moving to machines.

5 Mill orders. A close working knowledge of mill conditions enables us to handle mill orders with maximum efficiency, thus helping to relieve the burden on overtaxed mills. We...where possible...offer part shipment from our own warehouse stock.

● By working closely with the distributor, by asking for advice as well as metal, you can eliminate many delays, cut down useless paper work and step up production of finished war materials.

The Companies listed below are Distributors of the INCO High Nickel Alloys:

MONEL • "K" MONEL • "S" MONEL • "R" MONEL
"KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

They also supply other non-ferrous metals such as aluminum, copper and copper alloys.

★

DISTRIBUTORS

Atlanta—J. M. Tull Metal & Supply Co., 285 Marietta St.
Boston—Whitehead Metal Products Company, Inc. 235 Bridge St., Cambridge
Buffalo—Whitehead Metal Products Company, Inc. 254 Court St.
Chicago—Steel Sales Corporation, 3348 South Pulaski Road
Cincinnati—Williams and Company, Inc. 1921-1927 Dunlap St.
Cleveland—Williams and Company, Inc. 3700-3716 Perkins Ave.
Columbus—Williams and Company, Inc., 31 N. Grant Ave.
Dallas—Metal Goods Corporation, 1209 Texas Bank Bldg.
Denver—Hendrie & Bolthoff Mfg. & Supply Co. 1621-39 Seventeenth St.
Detroit—Steel Sales Corporation, 5151 Wesson Ave.
Houston—Metal Goods Corporation, 16 Drennan
Los Angeles—Pacific Metals Co., Ltd., 1400 S. Alameda St.
Milwaukee—Steel Sales Corporation, 647 W. Virginia St.
Minneapolis—Steel Sales Corporation, 529 S. 7th St.
Newark—Whitehead Metal Products Company, Inc. 205 Frelinghuysen Ave.
New Orleans—Metal Goods Corporation, 413 Canal Bldg.
New York—Whitehead Metal Products Company, Inc. 303 West 10th St.
Philadelphia—Whitehead Metal Products Company, Inc. 721-729 Arch St.
Pittsburgh—Williams and Company, Inc. 901-937 Pennsylvania Ave.
St. Louis—Steel Sales Corporation, 4565 McRee Ave.
San Francisco—Pacific Metals Co., Ltd., 3100 – 19th St.
Seattle—Eagle Metals Co., 3628 E. Marginal Way

IN CANADA:

Montreal—Robert W. Bartram Ltd., 277 Duke St.
Toronto—Alloy Metal Sales Ltd., 861 Bay St.
Vancouver—Wilkinson Company, Ltd., 190 Second Ave., W.

Inco Distributor Service

MILL...WAREHOUSE...FIELD

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 3

Knowing the Conditions . . . First Step Towards Longer Tube Life

Oxygen Concentration

The corrosion of most ordinary industrial metals and alloys usually requires the presence of oxygen. Its function is chiefly that of a depolarizer, oxidizing and removing the atomic hydrogen which is formed during the initial stage of corrosion, thereby allowing corrosion to proceed. The rate of corrosion of metals and alloys immersed in water is in most cases directly dependent upon the rate at which oxygen or any oxidizing agent can reach the surface to depolarize the hydrogen. In many cases, the rate of corrosion is almost directly proportional to oxygen concentration.

Composition of Corrodent

The influence of the degree of acidity or alkalinity and of oxygen or oxidizing materials on corrosion have been discussed. There are many other substances sometimes occuring in circulating media which may have a marked influence on corrosion of the tubes in a heat exchanger. These are listed and discussed as follows:

1. Carbon Dioxide is always present in air and is generally present in water, particularly in swamp and well waters. A solution of carbon dioxide in water reacts acid (carbonic acid) and, like other acid solutions, it accelerates corrosion. In the presence of dissolved oxygen, the rate of corrosion of carbonic acid waters may be particularly high.

2. Chlorine dissolves in water with the formation of hydrochloric and hypochlorous acids and such a solution may be very corrosive when appreciable quantities of chlorine are present. Fortunately, chlorine is not normally found in natural waters and, in the amounts usually added for the control of bacteria and algae, etc., it has no appreciable effect on corrosion. If added in uncontrolled amounts to water supplies, however, serious corrosion may result particularly near the feeding location. Trouble has also been experienced in industries where large amounts of chlorine or active chlorine compounds are used for bleaching purposes.

3. Hydrogen sulphide is a very active corroding agent even when present in relatively small amounts in circulating media. It is an acid and attacks most metals and alloys even in the absence of oxygen. Corrosion is usually of the concentration cell type, resulting in extensive pitting of the metal surface. Hydrogen sulphide and other active sulphur compounds are found in peaty soils, sewage, mineral waters, and in crude oils and other oil-refinery products. In the presence of oxygen, hydrogen sulphide may be oxidized to sulphurous and sulphuric acids.

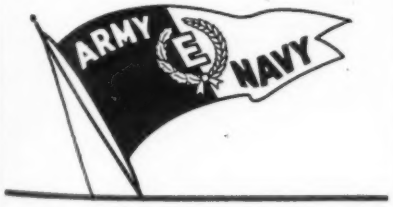
4. Moist ammonia vapors or water solutions containing appreciable amounts of ammonia have a very marked solvent action on copper and copper alloys; in addition, brasses of high zinc content (the yellow brasses) are attacked intergranularly by ammonia and its compounds, which may promote cracking of the metal in the presence of internal or external stresses. Ammonia is not often found in harmful quantities in natural waters. High concentrations may build up in the condensate of steam condensers where waters containing small percentages of ammonia are used for boiler water supplies. Ammonia is used quite extensively for the neutralization of acids in oil and gas vapors in refineries and should be controlled within very close limits to avoid corrosion and cracking of copper alloy tubes. Ammonia is also used in refrigerating systems and, through leakage, may be a source of contamination of circulating water used for condensers, heat exchangers, etc., in plants where both types of equipment are in service.

5. Salts in solution may retard or increase corrosion, depending upon their composition, concentration, conductivity, and other factors.

Factual Information Service Saves Costly Delays and Scarce Metals for Wartime Tube Users

The discussion of conditions affecting efficiency of Condenser and Heat Exchanger tubes, which appears on these pages, is one of Scovill's continuing series of informative bulletins available to all tube users today. Reprints of this article, together with Numbers 1 and 2, are available on request. To keep tubes in service under wartime conditions, a complete "Condenser Tube Booklet" is also available, with diagrams, formulae and authoritative discussions of types of corrosion, selection of alloys, and solutions of special maintenance problems. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Conn.

Sea water, containing approximately 3% sodium chloride and minor amounts of potassium chloride, magnesium chloride, magnesium sulphate, calcium sulphate, et cetera, is not in itself a serious corroding agent of copper and copper alloys. It is important to note, however, that sea water may carry appreciable amounts of other substances, depending on location, the season of the year, et cetera, which may accelerate corrosion materially. It is reported, for instance, that carbon dioxide or hydrogen sulphide in sea water causes the formation of a non-protective scale or film, thereby promoting the formation of concentration cells and intense localized pitting. Carbon dioxide and hydrogen sulphide may both occur only seasonally in harmful amounts. Entrained air in sea water may result in an intense local attack of heat exchanger tubes, depending upon the velocity and turbulence of the water, the size of air bubbles, et cetera. Natural fresh water supplies have a total solid content very much less than that of sea water, usually consisting chiefly of bicarbonates, sulphates, and chlorides. As a general rule, corrosion of copper and copper alloys is not serious in contact with fresh water. In some cases, dezincification has been experienced under some service conditions, but this form of corrosion has been largely overcome by the choice of a proper alloy; also, suspended solids or foreign material in fresh water may initiate "deposit attack" of the metal, but this type of attack can also be overcome successfully in most cases by screening of the water and a frequent cleaning of the tubes. Acid drainage from coal mines is discharged into many streams and may cause serious corrosion, depending upon the acid concentration and the presence of oxidizing agents, such as ferric sulphate; under conditions of this kind, relatively rapid uniform etching of condenser and heat exchanger tubing does take place.



Limitation order L-154 issued by the OPM. This order limits the use of non-ferrous condenser tubes in land power stations to Muntz metal for fresh water plants, and Admiralty metal for salt water plants. No non-ferrous metals containing more copper and more tin than these two are permitted by the order.

Stresses Acting upon Tubes

Stresses which may initiate or contribute to the failure of heat exchanger tubes may be classified as follows:

1. Internal strains set up by cold working.
2. Externally-applied tensile stresses.
3. Cyclic stresses.

Season cracking or corrosion cracking of brasses is the result of corrosion by specific reagents and particularly by mercury and mercury compounds and ammonia and ammonium compounds on *internally stressed* material. Cracking usually follows the grain boundaries.

Stress-corrosion cracking is similar to season cracking except that the stresses are externally applied.

Corrosion-fatigue cracking of tubes may occur from the simultaneous action of corrosion and *cyclic stresses* acting on the metal. In this connection, it should be noted that cyclic stress tends to accelerate corrosion of the pitting type, and corrosion, on the other hand, decreases the fatigue limit very markedly. Corrosion-fatigue cracks are trans-crystalline.

Contact with Dissimilar Metals

When dissimilar metals are in contact with each other and are immersed in a conducting medium, one metal (the anodic metal) undergoes an accelerated corrosion and the other (the cathodic metal) is correspondingly protected. Perhaps one of the most important controlling factors in corrosion of this type is the ratio of the cathode area to the anode area. As a general rule, the larger the cathode area, the greater is the corrosion at the anode. Other factors which influence galvanic corrosion are the resistance of the electrolyte, the formation of protective films or corrosion product over the metal surfaces, et cetera.

A 3-Way Service for Your Firm

The services which Scovill offers to its customers, and to every wartime user of Condenser and Heat Exchanger tubes, are not limited to the "Service in Manuals" described above. Scovill's "Service in Men" places at your disposal the advice and consultation of men with years of experience in practical tube problems; while Scovill's "Service in Metals" offers you complete laboratory and production facilities, available as national needs permit.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

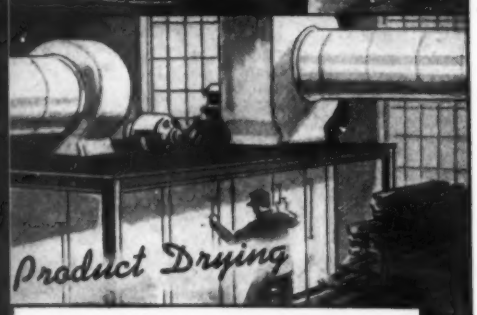
ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Individual units of equipment or complete control systems, for maintaining the desired temperature and humidity required for any manufacturing operation.

Systems for collecting and exhausting all kinds of air-borne hazards—dust from machining or polishing operations; fumes from processing tanks; steam, vapor or excess heat that hampers production.

All types of fan equipment or individually engineered systems, to meet each specific ventilating problem with the utmost efficiency and economy.



Custom-designed-and-built drying equipment of the unit or continuous type, to obtain exactly the characteristics desired in drying an endless variety of raw materials and finished products.

HOW A SHELL

THE CASING of this long, slim, deadly missile started life as a homely hunk of brass. But you can't take these slabs of brass and—presto!—turn them into shell casings. They're rough, bumpy—need a shave—before they can be drawn into smooth, glistening casings. So these shell cases in embryo—great rectangular planks of solid brass, 10 feet long, a foot wide and 2 inches thick—go to the "barber shop". Sharp, whirling milling cutters go to work, trimming off literally mountains of brass "Whiskers" or chips.

If allowed to accumulate, these chips would quickly overwhelm shop, machines and men. Here is a job for Air at Work . . . a hurricane of air, harnessed by a Sturtevant pneumatic conveying system. Heavy metal chips as well as heat and smoke are whisked away . . . metal is reclaimed . . . busy machines are kept cool for continuous work . . . men are more efficient . . . work is speeded.

This is another of those *yesterdays of pioneering* that are bringing Victory closer today. First developed for a Connecticut Brass Mill in 1910, similar slab milling chip exhaust systems are now at work in the foremost ammunition plants in the country. And it's just one of countless ways that Sturtevant is supplying the know-how and equipment to make Air serve the war effort.

Air Conditioning, Ventilating, Drying, Heating, Dust and Fume Control, Mechanical Draft . . . in designing and building these *precision* installations, we have learned many wartime ways to put air to work more *efficiently.* And we have unearthed many new developments that will make air an even greater ally of industry when Victory is won.

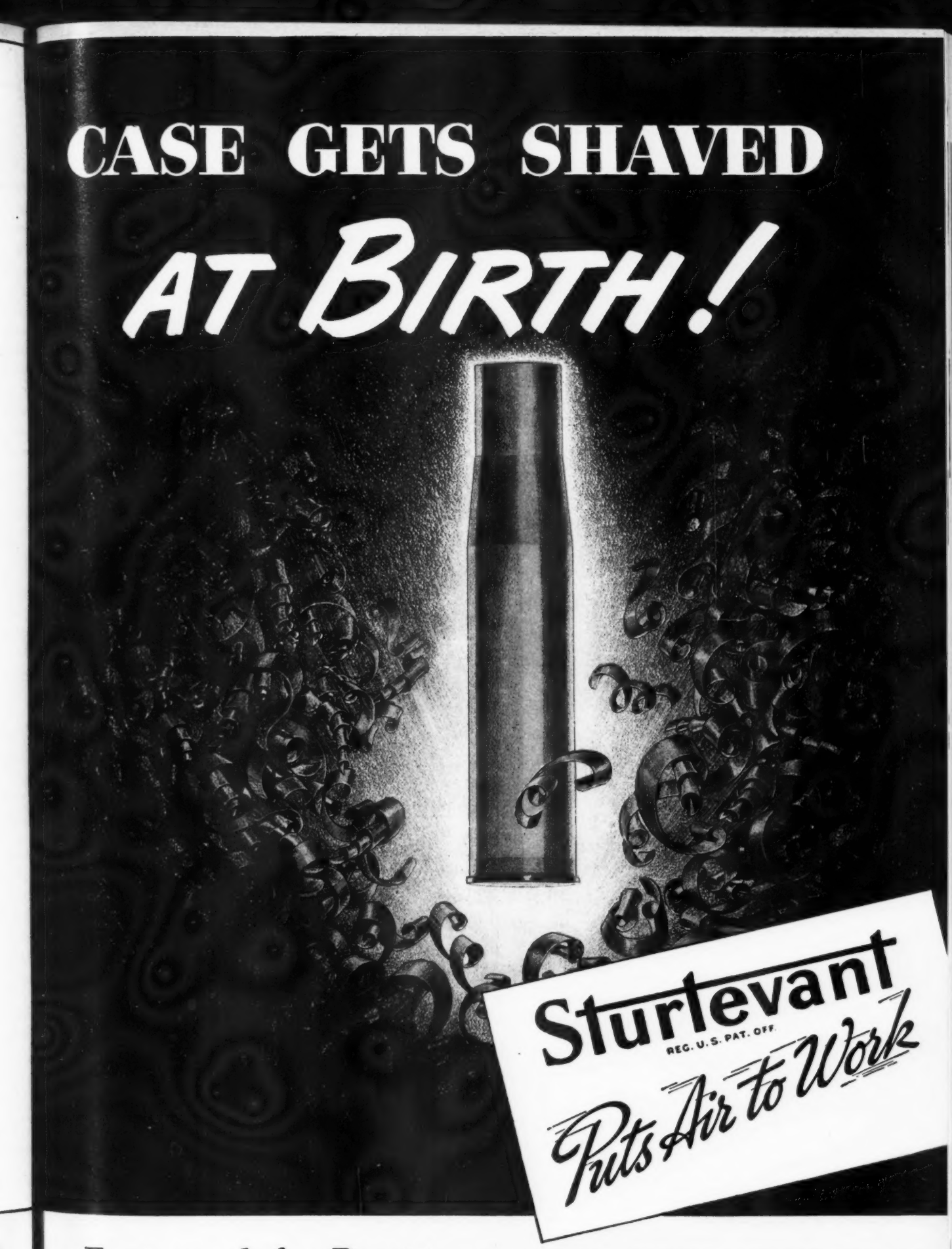
B. F. STURTEVANT CO., HYDE PARK, BOSTON, MASS.
Branch Offices in 40 Cities
B. F. Sturtevant Company of Canada, Limited—Galt, Toronto, Montreal

STURTEVANT—FOUNDER OF THE AIR HANDLING INDUSTRY

Sturtevant Systems AND EQUIPMENT

REG. U. S. PAT. OFF.

CASE GETS SHAVED AT BIRTH!



Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

Engineered for Precision VENTILATING, HEATING, AIR CONDITIONING, DRYING, DUST AND FUME CONTROL, PNEUMATIC CONVEYING, MECHANICAL DRAFT

In War Industries and in Power Plants
In Fighting, Transport and Merchant Ships
In War Transportation, Locomotives and Other Units

GLOBE STEEL TUBES IN GLOBAL-WAR SERVICE

The "emergency" found *Globe Steel Tubes* prepared...prepared because *Globe* engineers are veterans of more than 30 years' constant service on the pressure-tube "front."... Concentrating now, as always, on *Globe Quality* steel tubes, we faced no problem of "conversion" to meet the unprecedented demands of industry's war-production power plants...transport, merchant and warships...locomotives and other units of war power-equipment requiring super-quality and 24-hour-a-day operative ability in boiler tubes, condenser and heat-exchanger tubes, stainless and mechanical tubing.

GLOBE engineers offer their long experience and superior facilities to aid you in selecting steel tubes of proper characteristics for your specific needs.

GLOBE TUBES

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

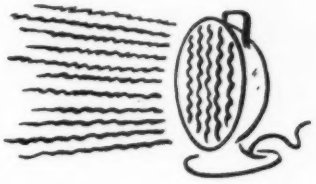
GLOBE STEEL Tubes

GLOBE STEEL TUBES CO., *Milwaukee, Wisconsin, U.S.A.*

Motors Run a Fever?

No wonder if they do more often today. They're working 3 and 4 times as many hours a year as in peace!

When a motor runs hot in your plant, do your men have explicit directions for locating the cause? If not, send in for your free copy of "Guide to Wartime Care of Electric Motors". Its QUICK DIAGNOSIS OF MOTOR AILMENTS is invaluable!



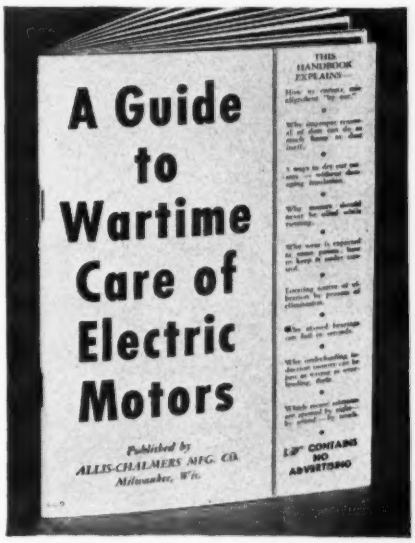
Friction makes heat — and so does electrical resistance. Pages 8 and 9 of Allis-Chalmers' new book tell how wartime preventive maintenance should fight friction . . . pages 16 and 17 outline strategy for preventing overload. Recommendations are simple, practical, *geared to wartime* — ideal for training.

Insulation is "fried" by excessive heat — bearings burned out — soldered connections melted. Play safe . . . put Allis-Chalmers' new motor maintenance guide to work protecting *your* motors!

HERE'S the arithmetic of the wartime motor maintenance problem: motors that worked 1800 hours in a peace year now work up to *8700 hours!*

A killing schedule—yet motors now must last *longer* than ever before — and wishing won't make it so.

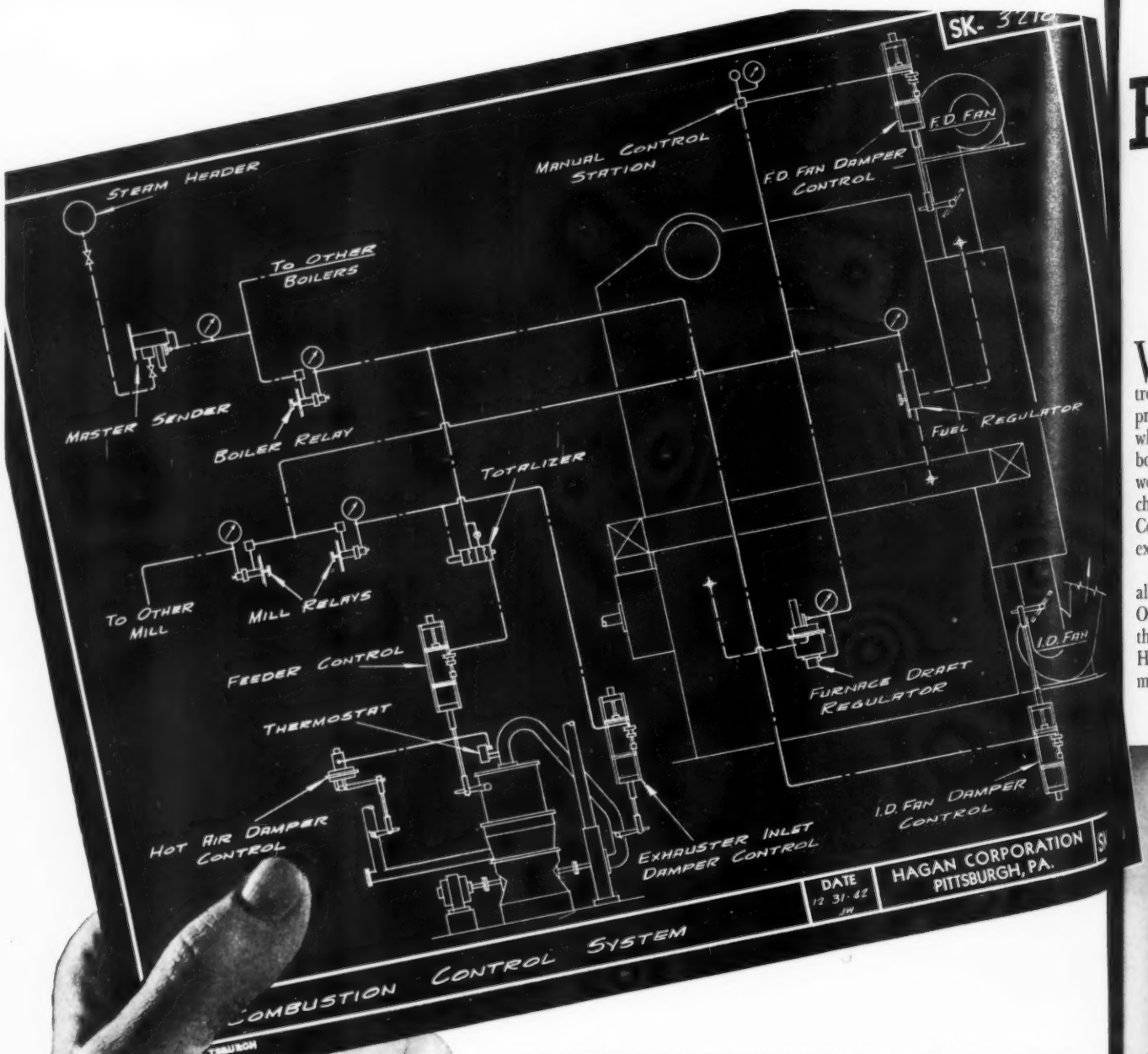
One thing will: the new *wartime* standard of motor care set forth in Allis-Chalmers' new motor maintenance guide. Already, 70,000 copies are in use in plants all over the U. S.!



Contents of this valuable new publication include the 9 main enemies of electric motors and how to fight them . . . dust, stray oil, moisture, friction, misalignment, vibration, uneven wear, overload and underload. Send in today for *your* free copy to ALLIS-CHALMERS, MILWAUKEE, WIS. A 1591

ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE



TRY YOUR ENGINEERING MIND OUT ON THIS — *Here is a diagram for a* complete *and* unexcelled *general boiler combustion control system. It isn't anybody's installation in particular, though it could be. Note its simplicity, the absence of complicating details. Imagine the freedom from responsibility such a complete coordination of working parts would give you. They are your eyes and your hands—tireless, dependable, always on the job.*

HAGAN
HALL
BUROMIN
CALGON

HAGAN AUTOMATIC COMBUSTION CONTROL PANEL *similar to one that would be used in the diagram illustrated. Hagan panels are delivered with all piping installed ready to hook up to the plant system. This saves days—sometimes weeks—of installation time.*

Blueprint to successful boiler operation

WHILE the design for a Hagan Automatic Combustion Control installation reproduced here is probably quite different from one which would meet the needs of your boilers, its essential characteristics would be the same. For they are the characteristics which make all Hagan Control equipment distinctive. For example:

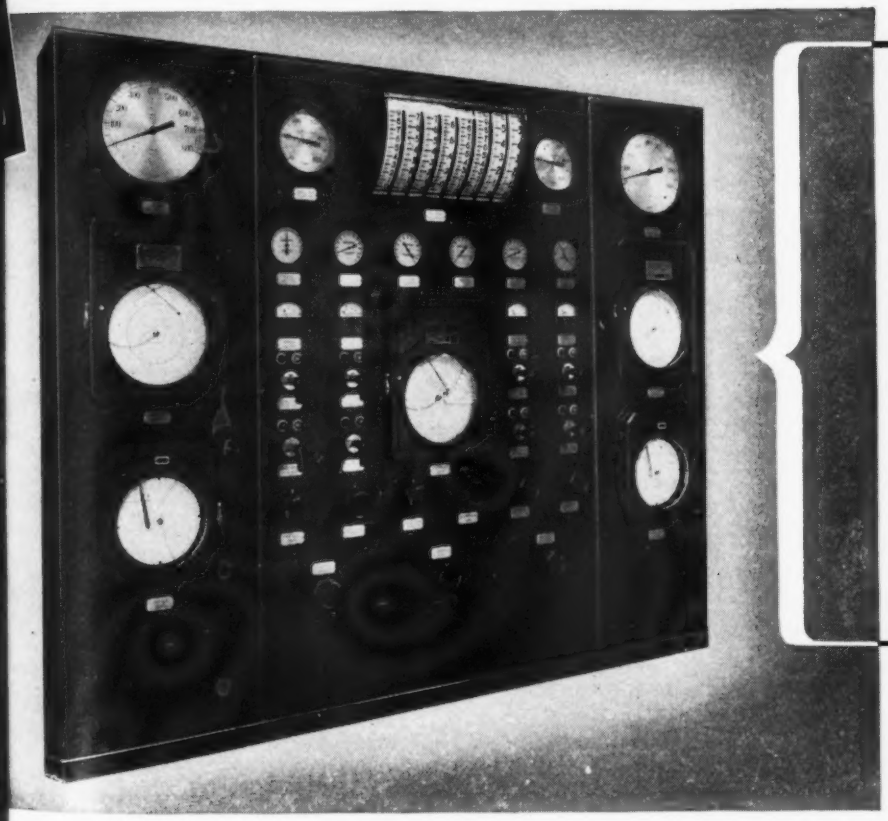
All Hagan Control Systems are alike in their operating simplicity. Ordinary help can easily take care of the largest or smallest installation. Hagan Control is so completely automatic it will operate dependably on its own with little or no supervision.

There would be no installation difficulty on old or new boilers. Hagan Control is so complete when it reaches you that it can be quickly installed without difficulty and in most cases without shutting down the boiler.

Built-in ruggedness has always been a Hagan feature in any of its equipment. Once installed you can look forward to years of uninterrupted trouble-free service.

For other important operating advantages which are definitely Hagan characteristics, you can count on — exceeding sensitivity to load conditions; accuracy of adjustments for small variations; speed of movement, with stability, throughout operating range; flexibility in meeting individual plant conditions. These are products of the engineering minds who pioneered in automatic combustion control and have consistently set the pace for this type of equipment.

Couple these facts with the five maximums promised by Hagan in the accompanying box and you will have the answer to Hagan leadership. Full details on request.



HAGAN CONTROL ASSURES

★ **MAXIMUM** quantity of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

★ **MAXIMUM** utilization value, uniform steam pressure and temperature, in accordance with demand.

★ **MAXIMUM** output from boilers of differing capacities, automatically.

★ **MAXIMUM** steam for production, by reducing loss of steam in frequent soot blowing.

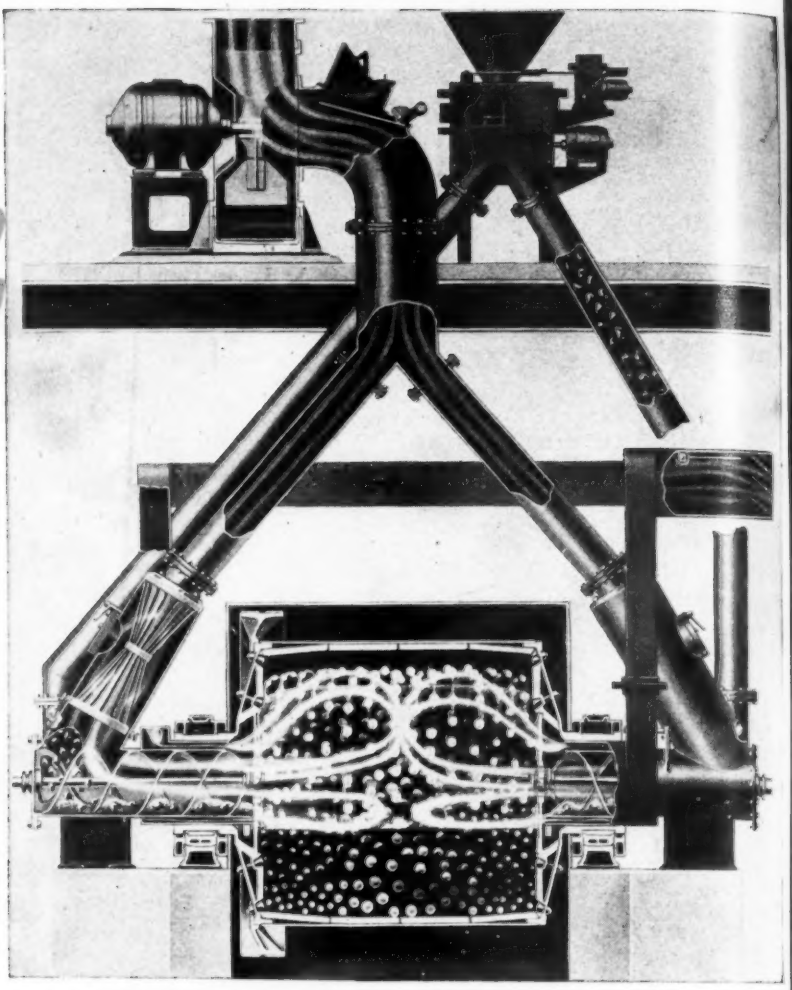
★ **MAXIMUM** protection of auxiliary equipment, fans, stokers, etc. by maintenance of uniform operating conditions.

HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

Wartime Duty



FOSTER WHEELER BALL MILLS

(Hardinge Type)

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

SAVE COAL

High fineness can be continuously maintained independent of wear *while mill is in service.* Lower carbon loss, more accurate combustion control, and less coal per lb. of steam combine for higher efficiency.

SAVE LABOR

Low speed, rugged construction, and simplicity of design insure least maintenance.

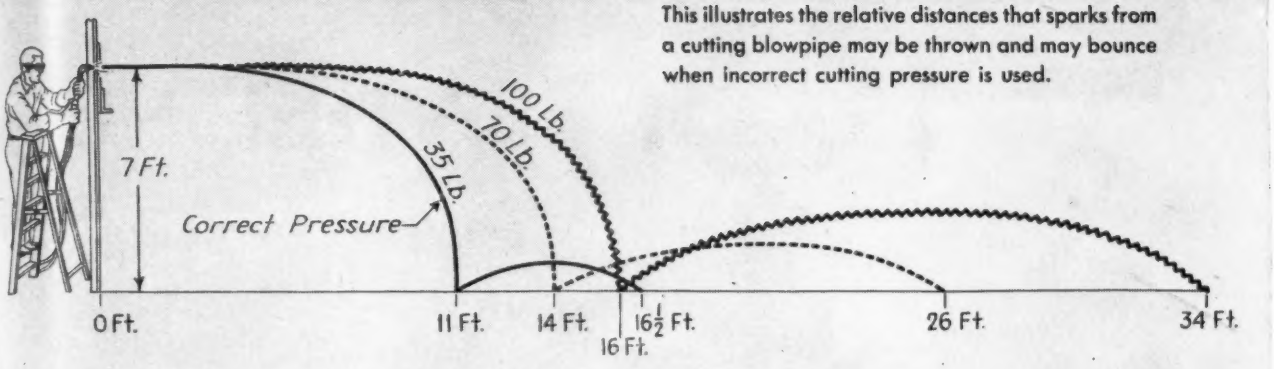
SAVE TIME

Operating records while steam generating units are in service show availability of 98-100% thus minimizing boiler outages attributable to pulverizer failure.

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK, N. Y.

FOSTER WHEELER

WATCH THOSE *Sparks*.. TO MINIMIZE FIRE HAZARD



During oxy-acetylene cutting operations, the larger the area into which sparks are thrown, the greater will be the danger of fire. Sparks scattered several feet from the scene of cutting may lodge in cracks or crevices of combustible material and smoulder there unnoticed until flames burst forth. Sparks should, therefore, be confined to as small an area as possible.

Avoid Excessive Pressures

A most important factor in controlling sparks is the use of no more than the correct oxygen pressure as specified in the instructions supplied with each blowpipe. Excessive oxygen pressure not only wastes oxygen, produces an inferior quality of cut, and slows cutting by the cooling effect of the excess oxygen, but also increases the distance that hot slag or sparks are thrown—particularly when the cutting is done in a horizontal position.

Use a Spark Shield!

An effective shield, which will reduce the distance that sparks are thrown, can be improvised by suspending sheet metal or asbestos paper 2 or 3 feet square, in the path of the sparks about 18 inches from the blowpipe. Such a shield will prevent sparks from flying or rolling great distances and will thereby lessen the danger of fire.

Instruction Books Available

The instruction books packed with all oxy-acetylene blowpipes supplied by Linde include charts showing correct gas pressures to be used. Duplicate copies will be sent, without charge, upon request. Be sure to specify the blowpipes you have.

Also available from any Linde office is the booklet "Preventing Welding and Cutting Fires."

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Office: New York, N.Y. Offices in Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD APPARATUS . . . OXWELD SUPPLIES

THE LINDE AIR PRODUCTS COMPANY
30 East 42nd Street, New York, N. Y.

Please send me without cost —

1. Duplicate copy of the instruction booklet for each of the blowpipes specified below.

☐ Oxweld Type..... ☐ Purox Type.....
☐ Prest-O-Weld Type.....

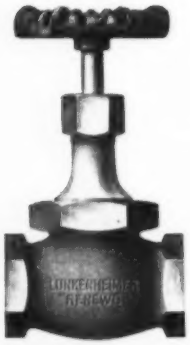
2. The booklet "Preventing Welding and Cutting Fires."

Name .....
Street and Number .....
City and State .....

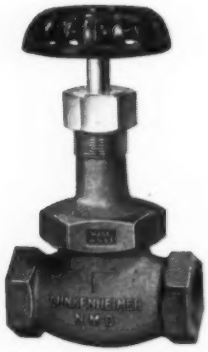
The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks.

Lunkenheimer

Vital Help



Bronze "Renewo"
200-300 lb. S.P.



Bronze "N-M-D"
Non-Metallic Disc
150 lb. S.P.

Bronze Regrinding
200-300 lb. S.P.

Iron Body "Ferrenewo"
150 lb. S.P.

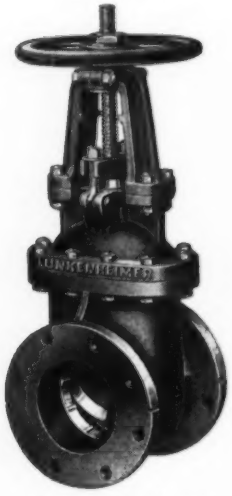
Bronze Gate
Double Wedge Disc
125-150 lb. S.P.

Bronze Gate
Single Wedge Disc
125-300 lb. S.P.

Bronze Regrinding
Swing Check
200-300 lb. S.P.

Bronze Needle Valve
200 lb. S.P.

Iron Body
"King-clip" Gate
150 lb. S.P.



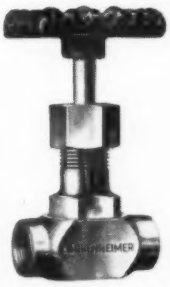
Iron Body Gate
125-250 lb. S.P.

Iron Body Globe
125-250 lb. S.P.

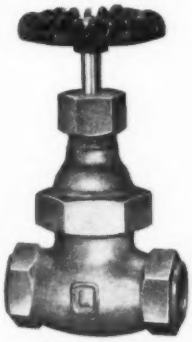
Iron Body
Swing Check
125-250 lb. S.P.

Valves . . .

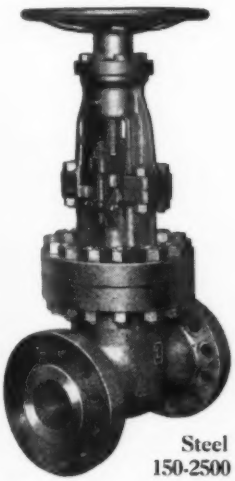
to Industry's Needs



Steel Needle Valve
3000 lb. W.O.G.



Steel Globe
Bonnet-Thread-Bushing
600 lb. S.P.

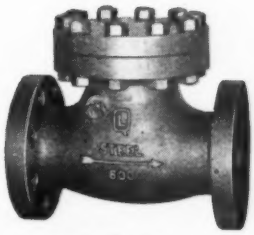


Steel Gate
150-2500 lb. S.P.

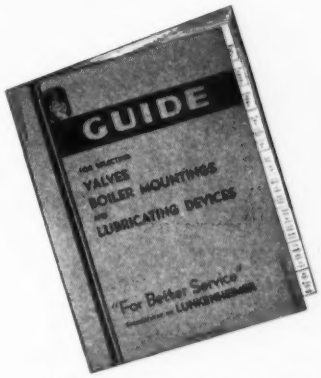
Illustrated are a few of the many types of Lunkenheimer Valves helping to produce vitally needed equipment for the Army, Navy, Maritime Commission and Air Force as well as other war agencies.

They're part of the complete line of valves made by Lunkenheimer for every industrial process—of bronze, iron, steel and corrosion-resistant alloys—from tiny needle types to massive power-plant valves—for pressures up to 2500 lb. S. P.

A further help is Lunkenheimer's nation-wide distribution through leading supply houses. Wherever there's war activity there's a Lunkenheimer distributor serving it.



Steel Check
150-2500 lb. S.P.



Ask for Lunkenheimer Catalog 78 and the Guide for selecting Valves, Boiler Mountings and Lubricating Devices.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

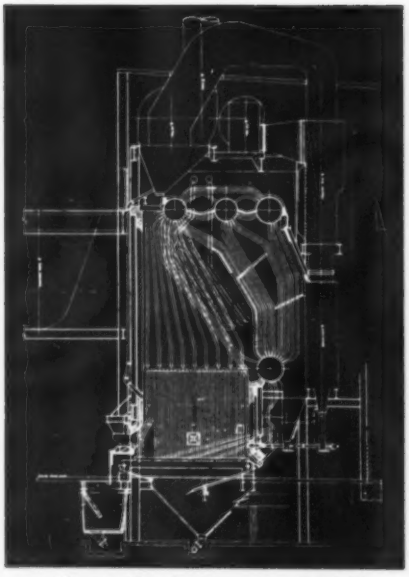
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

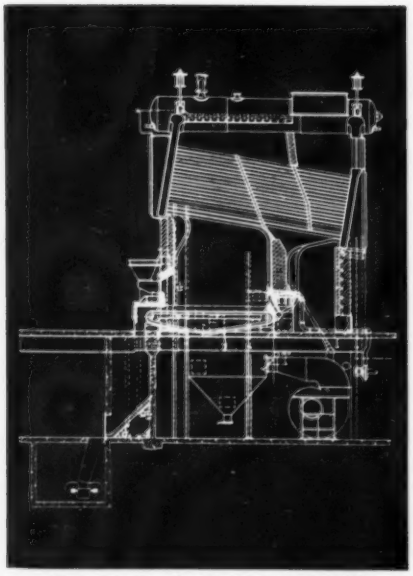
No. 28-106-42

DETROIT ROTOGRATE STOKER

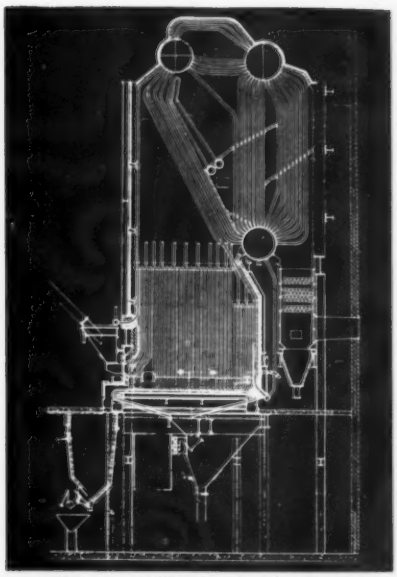
PROVEN SUCCESSFUL WITH MEDIUM AND LARGE UNITS



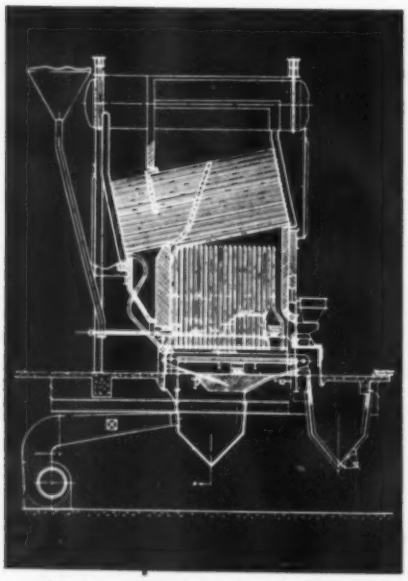
Illinois Coal—Capacity 75,000 pounds steam per hour.



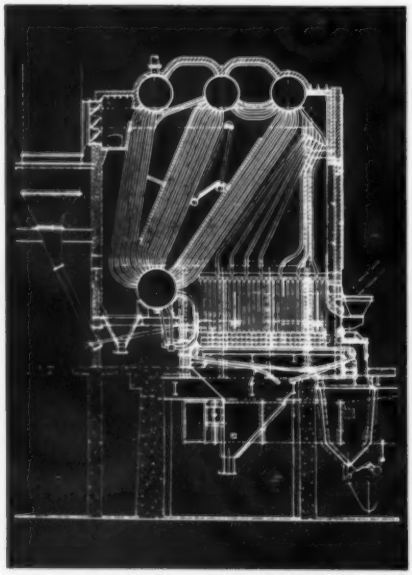
Kansas Coal—Capacity 30,000 pounds steam per hour.



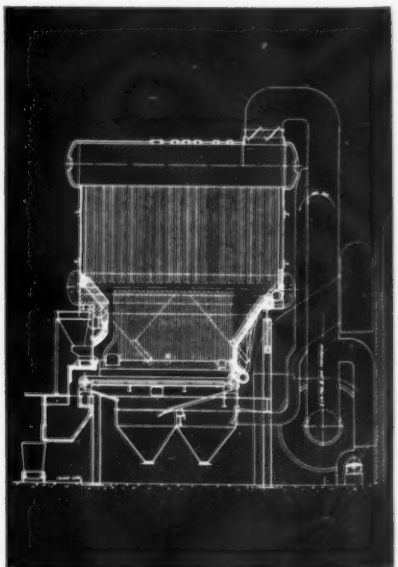
Indiana or Illinois Coal—Capacity 225,000 pounds steam per hour.



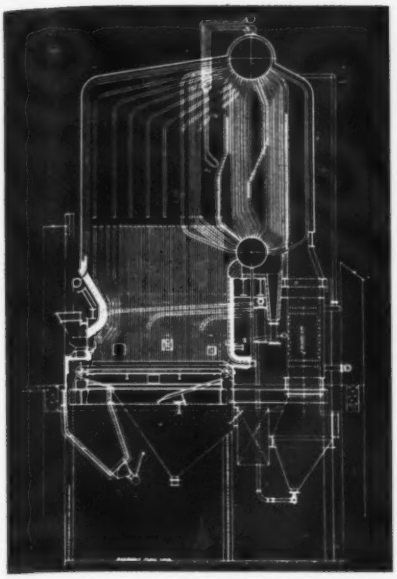
Western Kentucky Coal—Capacity 80,000 pounds steam per hour.



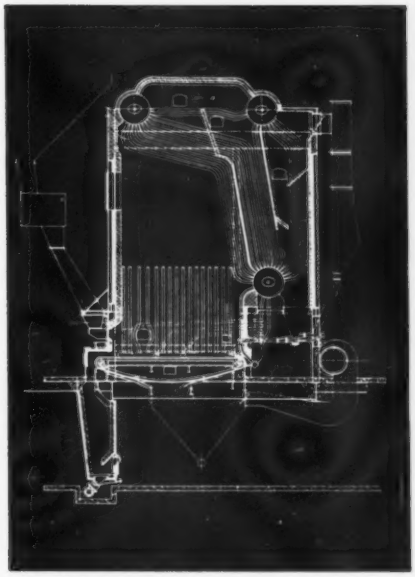
Iowa Coal—Capacity 50,000 pounds steam per hour.



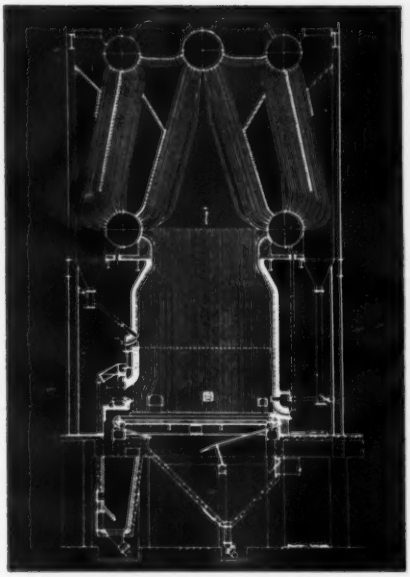
West Virginia Coal—Capacity 70,000 pounds steam per hour.



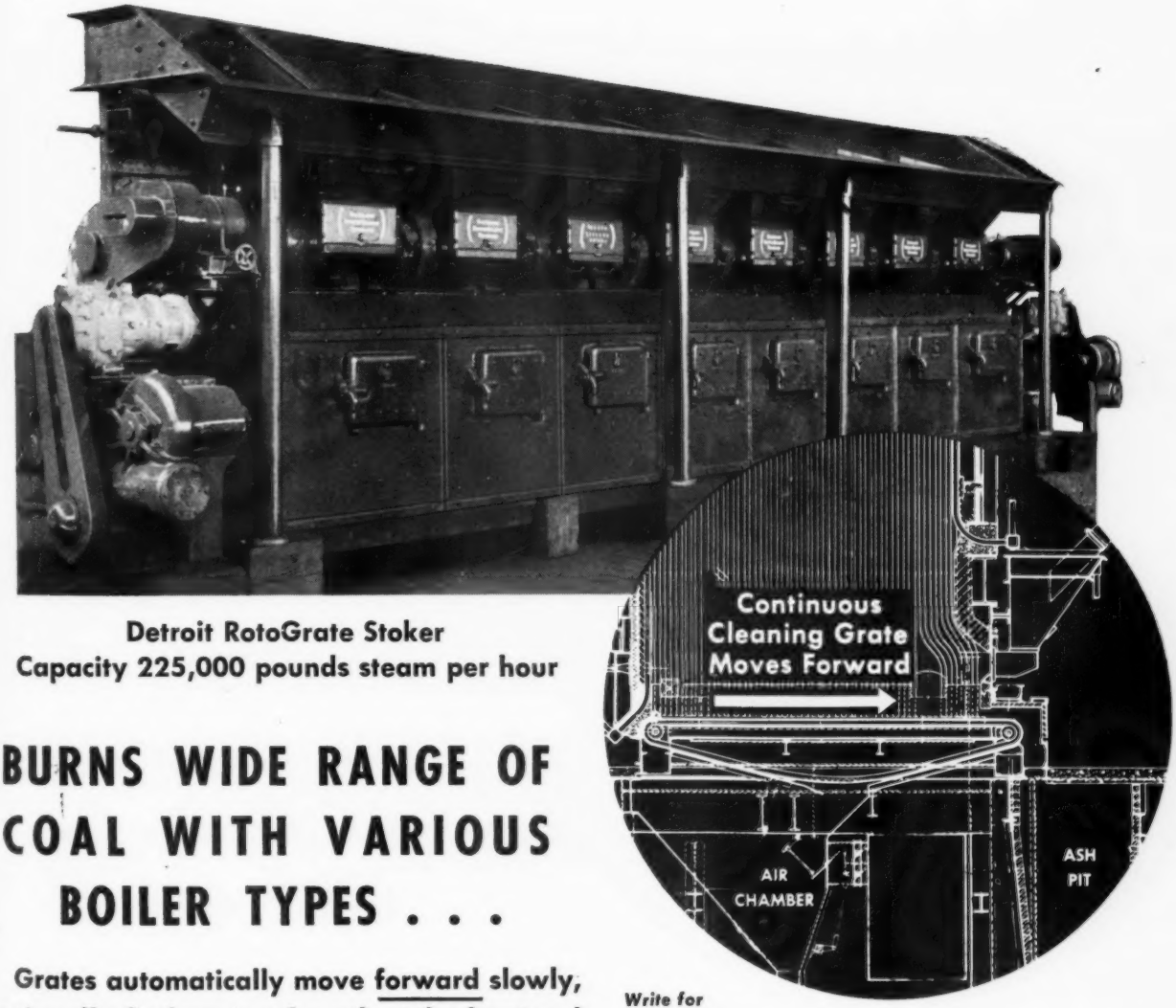
Tennessee or Eastern Kentucky Coal—
190,000 pounds steam per hour.



Eastern Kentucky Coal—Capacity
75,000 pounds steam per hour.



Illinois Coal—Capacity 225,000
pounds steam per hour.



Detroit RotoGrate Stoker
Capacity 225,000 pounds steam per hour

BURNS WIDE RANGE OF COAL WITH VARIOUS BOILER TYPES . . .

Grates automatically move forward slowly, continually discharging the ash at the front end of the furnace. Fine particles of fuel are burned in suspension and the coarse coal on the moving grate, with no special coal preparation.

Write for Bulletin

DETROIT STOKER COMPANY

General Motors Building
Detroit, Michigan

"Our Natural Selection

View of the Boiler Room of the R. K. LeBlond Machine Tool Co. showing the 3 Yarway Seatless Tandem Blow-Off Valves on boiler mud drums.

YARWAY

nwas

YARWAY SEATLESS TANDEMS"

(Says R. K. LeBlond Machine Tool Co.)

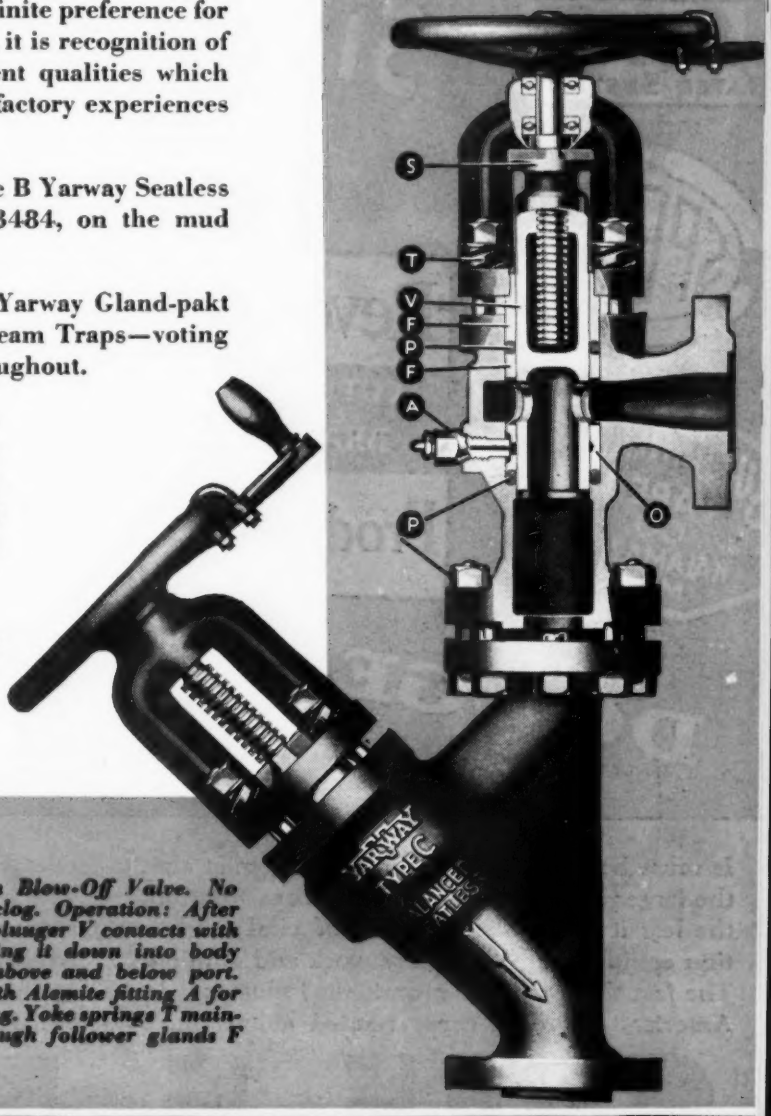
WHEN a firm so well known for mechanical excellence in their own products expresses such definite preference for the Yarway Seatless Blow-Off Valve design, it is recognition of sound valve engineering—of those inherent qualities which have been responsible for the highly satisfactory experiences of more than 12,000 Yarway Valve users.

This installation comprises six 2½" Type B Yarway Seatless Valves used in tandem, Fig. Nos. 3482-3484, on the mud drums of three 160-lb pressure boilers.

This Cincinnati plant is also a user of Yarway Gland-pakt Expansion Joints and Yarway Impulse Steam Traps—voting a "straight ticket" for Yarway quality throughout.

Whatever your Blow-Off Valve requirements, there is a Yarway Valve specifically designed for the pressure, purse and purpose. Write for Catalog. Section B-422 for pressures up to 400 lb; section B-431 for pressures up to 2500 lb.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia



The Yarway Seatless Tandem Blow-Off Valve. No seat to score, wear, leak or clog. Operation: After valve is closed, shoulder S on plunger V contacts with upper follower gland F, forcing it down into body and compressing packing P, above and below port. Annular groove O connects with Alemite fitting A for lubricating plunger and packing. Yoke springs T maintain continuous pressure through follower glands F on packing rings P.

BLOW-OFF VALVES

It must be apparent to any thinking man that the larger and more prominent the organization, the less it leaves the selection of vital production equipment to mere guesswork and opinion. The fact that the most prominent industrials in America, including those named above, have selected Sullivan Air Compressors is a judgment which *no* buyer who wants the utmost in dependability can afford to overlook. SULLIVAN MACHINERY COMPANY, Executive Offices: Michigan City, Indiana. *In Canada:* Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.

SULLIVAN

Air COMPRESSORS

PULLMAN-STANDARD CAR MANUFACTURING CO.
Built by Pullman

SOLAR AIRCRAFT COMPANY

CRIBBEN AND SEXTON COMPANY

SERVEL GAS REFRIGERATOR

BENDIX AVIATION LTD

M-R-C Strom SRB GURNEY BALL BEARINGS

CHAMPION SPARK PLUGS

BELL Aircraft
Airacobras for victory

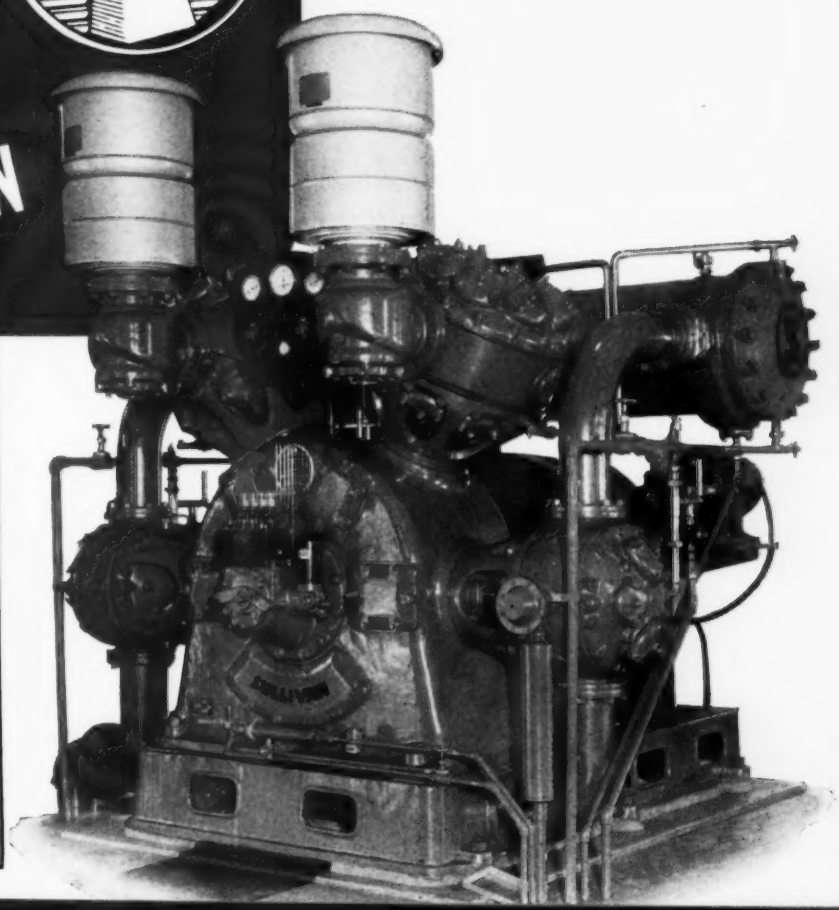
SAVAGE ARMS CORPORATION

FM

WEIL-McLAIN

PORTLAND PENN-DIXIE CEMENT

They Bought SULLIVAN Air Compressors



OFFICES

BOSTON . . . . 104 Brookline Ave.
CHICAGO . . 307 No. Michigan Ave.
NEW YORK . . . . . 30 Church St.
PITTSBURGH . . . 47 Terminal Way
ST. LOUIS . . . . . 2639 Locust St.
SAN FRANCISCO . . . . 145 10th St.
LOS ANGELES . . 2900 Santa Fe Ave.
DETROIT . . 2051 W. LaFayette Ave.
Birmingham, Butte, Dallas, Denver, Duluth, El Paso, Huntington, Knoxville, Scranton, Salt Lake City

PRODUCTS

HEAVY DUTY, SINGLE OR TWO STAGE STATIONARY AIR COMPRESSORS IN ANGLE, V-VERTICAL, VERTICAL OR HORIZONTAL TYPES IN SIZES FROM 1/4 TO 3000 H. P. ALSO A COMPLETE LINE OF PORTABLE COMPRESSORS

this information will help

1 Those who face the problem of making their present stokers last for the duration.

2 Those who have recently installed stokers and wish to become more familiar with the fundamentals of operation and maintenance.

3 Those who are planning to convert to stoker firing.

"Fundamentals of Stoker Operation and Maintenance" should prove helpful regardless of what stoker you have or may install because it covers all types—

Single Retort Underfeed
Multiple Retort Underfeed
Chain and Traveling Grates
Spreader

While the information is based on experience with the various types of C-E Stokers, the fact that it deals with the fundamentals of operation makes it generally applicable to all types, regardless of manufacturer.

Having the most complete line of stoker equipment on the market, and the experience gained in the manufacture and installation of more than 17,000 stokers of all types, Combustion Engineering is especially qualified to provide competent advice and assistance to stoker users.

Today, as never before, it is vitally important—really a patriotic duty—that equipment be maintained at the peak of its output and efficiency. This, added to the difficulties often encountered in obtaining repair parts, emphasizes the necessity of competent operation, regular inspection and adequate maintenance.

The collected information in this booklet is designed to help you to achieve these objectives. Write for your copy. No obligation, of course.

3 **If you are contemplating conversion** from oil to coal, you will be interested in the pamphlet "Factors Governing Conversion from Oil to Coal Firing." It is a very practical discussion of the question built around several actual case studies. We shall be glad to send a copy upon request.

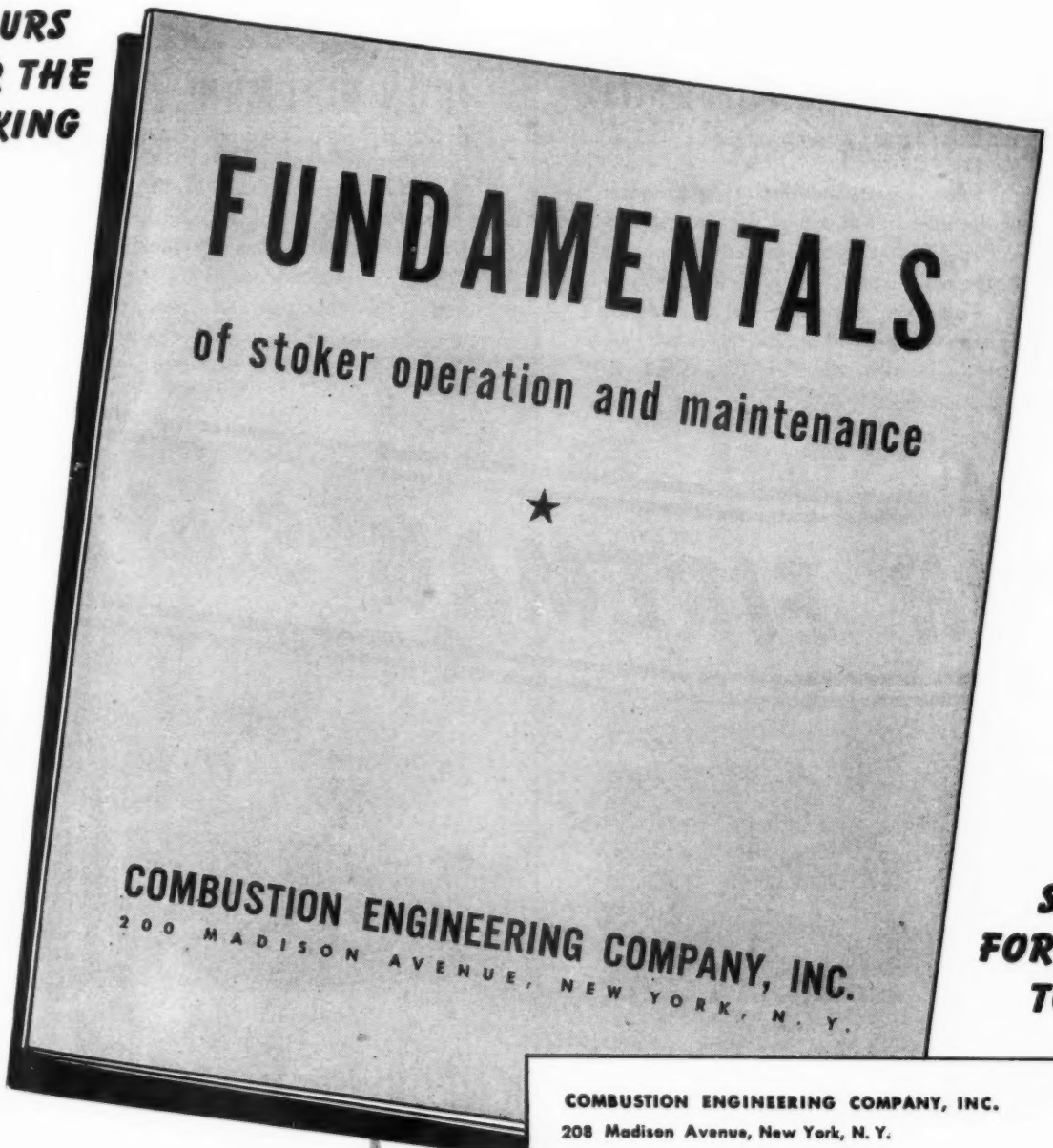
A-712

COMBUSTION ENGINEERING

208 MADISON AVENUE, NEW YORK, N. Y.

Groups of STOKER users

YOURS FOR THE ASKING



SEND FOR A COPY TODAY

MAIL THIS COUPON

COMBUSTION ENGINEERING COMPANY, INC.
208 Madison Avenue, New York, N. Y.

Please send me:

☐ "Fundamentals of stoker operation and maintenance"
☐ "Factors governing conversion from oil to coal firing"

NAME.....

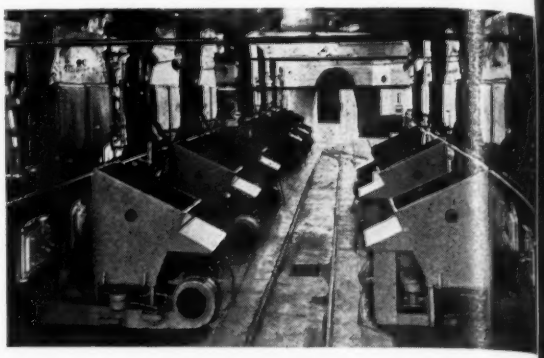
COMPANY.....

ADDRESS.....

CITY..... STATE.....

WACO DOUBLES STEAM OUTPUT WITH IRON FIREMAN STOKERS

LAST year Waco Aircraft installed Iron Fireman stokers to replace another type of firing equipment which could not carry the steam load for heating and processing. The plant's capacity was expanded and with even a greater steam demand, two Iron Fireman pneumatic spreaders, firing one boiler, carry the load that required two boilers before.



Bear Creek Pumping Station of National Transit Co., Parker's Landing, Pa.

IRON FIREMAN DELIVERS GREATER FIRE POWER FOR OIL PUMPING STATION

URGENT war needs make it necessary to operate the Bear Creek Oil Pumping Station of the National Transit Co. at top efficiency 24 hours a day, 7 days a week. Here 9 Iron Fireman Poweram underfeed stokers are maintaining a steady steam pressure, under heavy load conditions, that enables the pumps to operate continuously, at top capacity.

IRON FIREMAN Stokers

American Pad & Textile Co., Greenfield, Ohio

TEXTILE PLANT DOUBLES PRODUCTION NO INCREASE IN FUEL COSTS WITH IRON FIREMAN

WAR orders have more than doubled the production of the American Pad & Textile Co. Yet the plant has been able to operate with the same boilers as before with no increase in fuel costs. Here three Iron Fireman pneumatic spreader stokers fire 200 horsepower boilers.

Pacolet Manufacturing Co., New Holland, Ga.

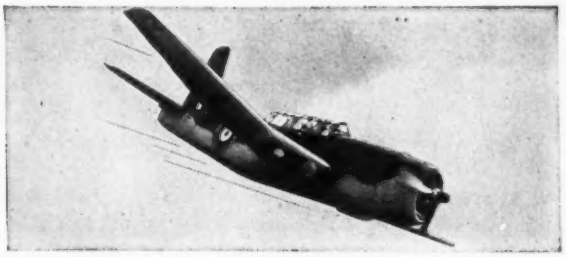
IRON FIREMAN CUTS STEAM COSTS $14,784 A YEAR AT PACOLET MILLS

IRON FIREMAN spreader stokers have reduced fuel costs 32% at the Pacolet Mills, now actively engaged in war production. The investment will liquidate itself in a short time and the savings can then be used for war bonds and taxes.

U. S. Department of Agriculture Laboratory, Wyndmoor, Pa.

IRON FIREMAN DEVELOPS 79.6% EFFICIENCY AT WYNDMOOR LABORATORY

AFTER this plant was put into operation, and official tests were made by the U. S. Bureau of Mines Fuel Economy Service, the boiler efficiency proved to be 79.6%, approaching the maximum for simple boiler design without extended-heating surface. Three 2000-lb. per hour Iron Fireman pneumatic spreaders produced this remarkable result.

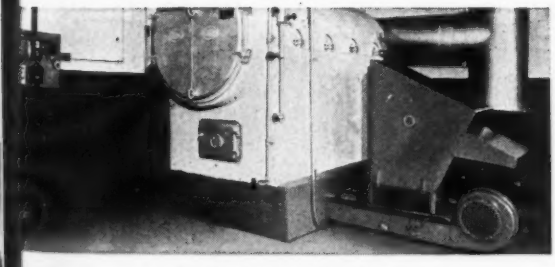


VULTEE AIRCRAFT INSTALLS 9 IRON FIREMAN STOKERS IN ITS NEW PLANT

VULTEE reports the following accomplishments with Iron Fireman firing: A steady supply of steam, right around the clock, even after heavy withdrawals of process steam; no smoke nuisance; clean boiler room and surroundings. Nine Iron Fireman "Coal Flow" stokers provide the process and heating system steam.

are Doing Vital War Jobs

★ ★ ★ ★ ★ ★ *Iron Fireman stokers . . .*



Berwick Weaving, Inc., Berwick, Pa.

PENNSYLVANIA PLANT CHANGES TO COAL . . . SAVES $3000 A YEAR

AT the Berwick Weaving plant, an Iron Fireman Poweram saves over $3,000 annually in fuel costs. In addition, uniform temperature, so necessary in textile manufacture, is maintained. Today, in tens of thousands of boiler rooms, Iron Fireman coal stokers, burning an unrestricted fuel, are helping vital war industries meet war needs by stepping up steam output 10% to 35%.

1 Increase steam output from 25% to 50% in existing boilers. Provide greater fire power for war production. ★ ★

2 Burn coal, America's plentiful fuel. Provide plants converting from oil and gas with vital steam and heat necessary to carry on war production.

3 Save critical materials. When steam step-up is necessary, new or large boilers need not be purchased, for very often two stoker fired boilers will do the work of three hand fired boilers.

4 Save money for bonds and taxes. Many thousands of Iron Fireman stokers now in operation are saving vast sums of money that can be put into war bonds or applied on the increasing tax load.

Give Iron Fireman an opportunity to show what can be done in your boiler room. Iron Fireman stokers are still available for industrial uses. Write, wire or phone, Iron Fireman Mfg. Co., 3351 W. 106th St., Cleveland, O.

IRON FIREMAN Automatic Coal Stokers

10 YEARS *of proof...*

Ten years ago, Steel and Tubes announced a new tube for pressure use—a radically new tube—a better tube.

But it was unlike any welded pressure tube ever made before. It was made by a new process—that cold forms flat-rolled steel to tubular shape then *electric resistance welds* it into a tube with a weld as strong as the wall.

From this process, Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes have acquired many features not attained commercially in tubes made by other processes—consistent uniformity in wall thickness, diameter, concentricity, strength, weight, ductility and scale-free surface.

During the past ten years, millions of feet of ELECTRUNITE Tubes have been installed in steam generating and heat transfer units of every type—fire tube and water tube; bent and straight; high and low pressure; stationary, locomotive and marine boilers; industrial condensers, heat exchangers and evaporators.

Now they can present ten years of proof of their soundness, safety and economy.

Today, Republic ELECTRUNITE Boiler, Heat Exchanger and Condenser Tubes meet the requirements of:

American Society of Mechanical Engineers—A. S. M. E. Boiler Construction Code S-32.

Association of American Railroads—A. A. R. Specification M-108.

American Bureau of Shipping.

Lloyd's Register of Shipping.

Refrigerating Machinery Association.

U. S. Department of Commerce, Bureau of Marine Inspection and Navigation.

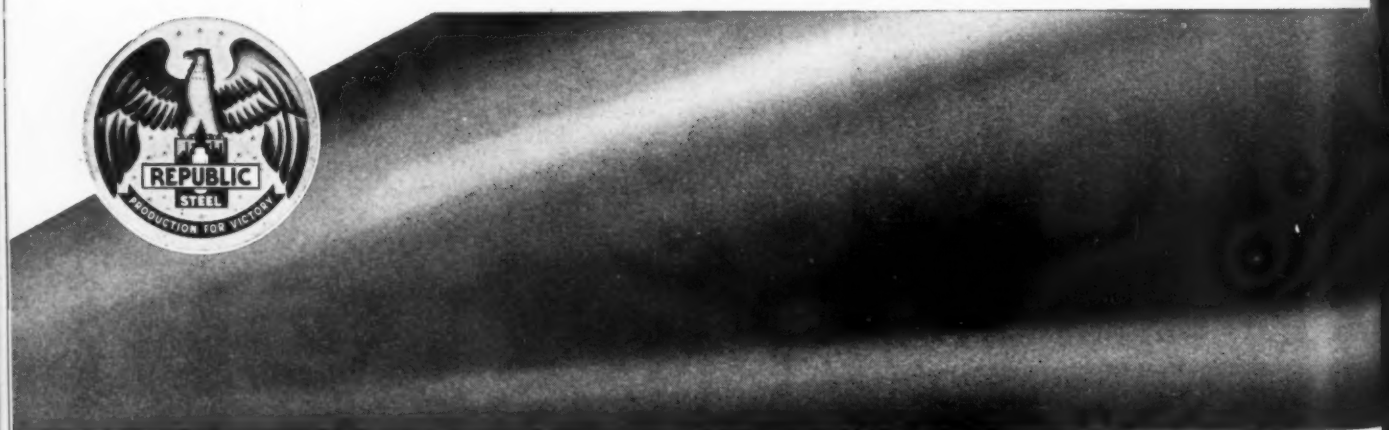
U. S. Maritime Commission.

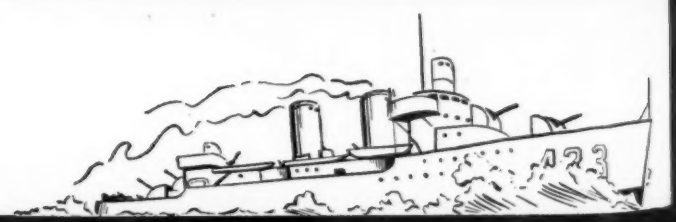
U. S. Navy—Specifications 44-T-42 and 44-T-11.

They also are covered by A. S. T. M. Specifications A-178, A-226, A-249, A-250 and A-214—and by Federal Specification WW-T-731.

Republic ELECTRUNITE Tubes are easy to install—save retubing time. Users report up to 30% saving in installation cost. Write us for complete detailed information.

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
Sales Offices · Cleveland, Ohio
GENERAL OFFICES • • CLEVELAND, OHIO
Berger Manufacturing Division
Culvert Division • Niles Steel Products Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York, New York



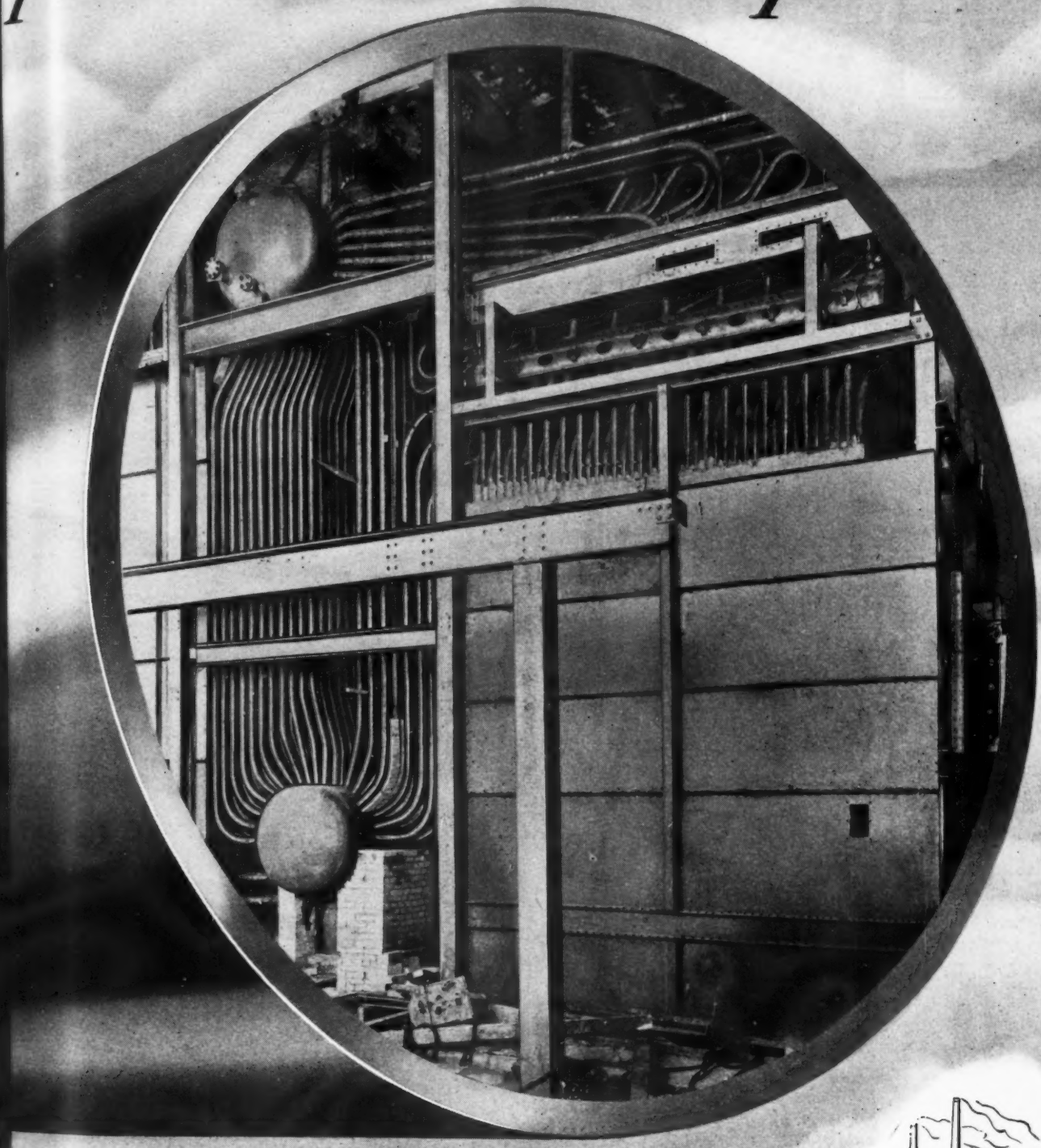


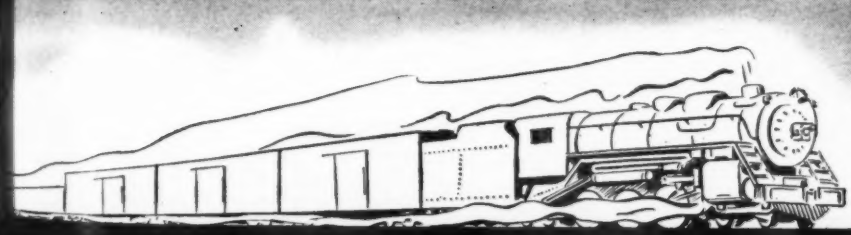
Republic

ELECTRUNITE*

*Reg. U. S. Pat. Off.

plus this wide acceptance





ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

POMONA PUMPS STRETCH YOUR PUMPING DOLLAR

TAKE ADVANTAGE OF CONSTRUCTION

ARE YOU TAKING *FULL* ADVANTAGE OF POMONA'S MANY CONSTRUCTION FEATURES?

Pomona owners are doubly fortunate in these times because no other type pump can match Pomonas for high efficiency . . . for adaptability to varying job requirements . . . for low maintenance and operating costs . . . and for all-around ability to handle virtually *any* pumping application encountered.

Among the *many* construction features that make Pomonas so uniformly efficient under a wide variety of operating conditions, the following are typical . . .

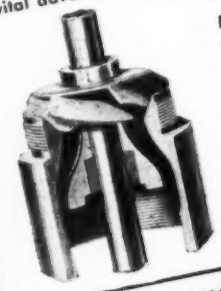
VERTICAL DESIGN

Because Pomonas are *vertical* pumps they require a minimum of floor space . . . in fact, can be mounted directly *over* tanks, vats, or sumps. No costly foundations are needed, no need to disturb existing plant installations. In addition, they require no priming to start, so may be located in out-of-the-way places unsuited to other equipment or can be operated by remote control. ***No other pump is so easy to move from one job to another. No other pump operates with so little attention!***

Let your nearby Pomona dealer check over your installation and suggest ways you can make greater use of the many advanced construction features incorporated in your Pomona pump!

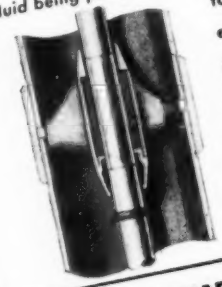
SEMI-OPEN IMPELLERS

Pomona's Semi-Open Impellers and Bulbous Vaned Pump Bowls represent a vital advancement in both design and performance. Pomona impeller clearance can be adjusted quickly and easily at the pump head, permitting pump capacity to be varied up to 60% of design point without costly throttling. Semi-open impellers will also handle gritty, pulpy or fluctuating flows more efficiently, and greatly minimize risk of vapor, gas or air locking. **Thus, Pomonas can be quickly adapted to a wide range of pumping requirements and fluids with uniformly high operating efficiency!**



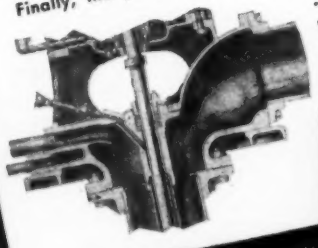
WATER LUBRICATION

In Pomonas, ALL bearings below the motor head are self-lubricated by the fluid being pumped. There are no oil tubes or grease chambers to leak, therefore no risk of contaminating either product or equipment. Also, because lubrication is foolproof, positive, Pomonas take care of themselves without need for frequent attention. **You can use your Pomona for practically any pumping job in your plant with perfect safety to the pump and to the product!**



OPEN DRIVE SHAFT

Pomona impellers are driven by an open drive shaft which eliminates the buying, installing and servicing of a separate housing when conversions are made. Because there are no oil tubes or grease chambers, Pomonas handle fluids under a wide range of temperatures, further increasing their versatility. Finally, the pump can be lengthened or shortened by simply adding or removing standard length shaft sections . . . can be converted from deepwell primary water supply to close-coupled industrial pumping—or vice versa—at minimum cost. **Pomona's need never be idle!**



POMONA
Water-Lubricated
PUMPS

DIVISION OF JOSHUA HENDY IRON WORKS

● Water meters like Sloan Flush Valves are most often taken for granted. Perhaps that's because they both give you trouble-free service year in and year out. But the time has come when a little attention to small details (your Sloan Flush Valves) will pay big dividends in many more years of trouble-free service.

They rarely need attention BUT... they deserve it now

● We urge you to call in a master plumber today and have him check every one of your Sloan Flush Valves—probably many of them will need no attention whatever—probably only a few repairs will be required—but, remember, a single part for replacement is a lot easier to get than an entire new Flush Valve. You need to have the assurance that your every Sloan Flush Valve is working perfectly; still as good as new, and ready for many more years of trouble-free service.

All the material used in the manufacture of your Sloan Flush Valves is on the critical list. Conserve vital metals by proper maintenance.

SLOAN *Flush* VALVES

SLOAN VALVE COMPANY... 4300 WEST LAKE STREET • CHICAGO

14 years of continuous service

In spite of greatly increased war demands, the boilers in the power plant of a Pittsburgh steel company have operated for 14 years with no unscheduled outages. This company has been a client of Hall Service during the entire period.

One boiler "pinch hits" for six

An army tank manufacturer needed considerable new steam capacity. It was planned to replace 6 old boilers with 3 new ones. During the changeover one new boiler was forced to operate continuously at 400% rating to handle the load. The water treatment established by Hall Laboratories functioned perfectly. Not one tube burned out . . . not one minute's production time was lost.

No forced shutdowns in 6 years

A large company making paper board has been operating under Hall Service for six years. In that time no forced shutdowns have occurred because of scale, corrosion, embrittlement, carryover or other boiler ills due to water.

Somebody ought to strike a medal for them

WAR PRODUCTION HAS PRODUCED SOME VALIANT RECORDS FROM PEACE-TIME BOILER VETERANS

IN a thousand industrial power plants sturdy "old timers" in the boiler army have been meeting the severest strain in their years of service and carrying on with a minimum of casualties.

It wasn't like that in World War I when boiler shutdowns for repairs were a daily crisis in war industries and there wasn't any help for it.

That costly experience gave birth to a chain of developments which altered the whole course of boiler practices in the industrial world.

First, Hall chemists, after years of penetrating research, found the right answer to scientific boiler water conditioning. Next, Hall Laboratories instituted the system for preventive care which has made it known throughout the world. Then Hall field engineers put this service into operation in the leading power plants throughout the nation.

That's why boiler casualties in World War II are the lowest in history. Preventive care is a "must" in every important power plant today. It is the only insurance against boiler ills which have their origin in water conditions. No plant is so fully equipped to meet its own problems that it can afford to be without the specialized assistance Hall offers.

For your own plant security it will pay you to investigate what Hall preventive care has to offer.

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.

A Subsidiary of Hagan Corporation

HAGAN
HALL
BUROMIN
CALGON

HALL SYSTEM
of Boiler Water Conditioning

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

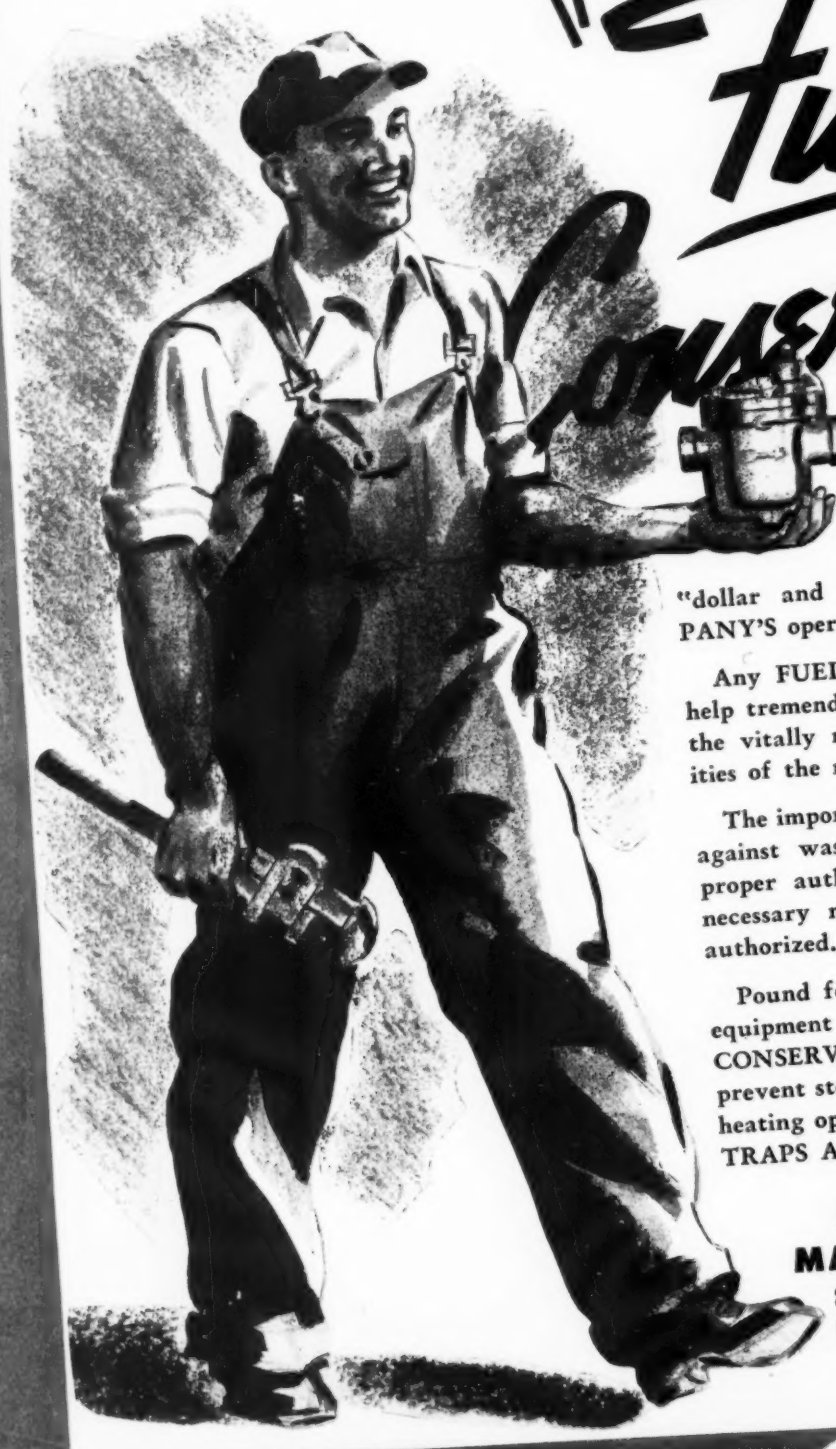
They sold their stock of spare tubes

Before Hall Service was started in a certain power plant, the maintenance department had to keep a big stock of spare tubes on hand at all times. After Hall Service began, no more tubes burned out over a stretch of years, so they decided to sell most of their now unnecessary surplus.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

ARMSTRONG

"Fuel Conservation"



THIS year, FUEL WASTE is more than just a matter of "dollar and cents" on YOUR COMPANY'S operating statement.

Any FUEL SAVINGS you can make help tremendously in easing the load on the vitally needed transportation facilities of the nation.

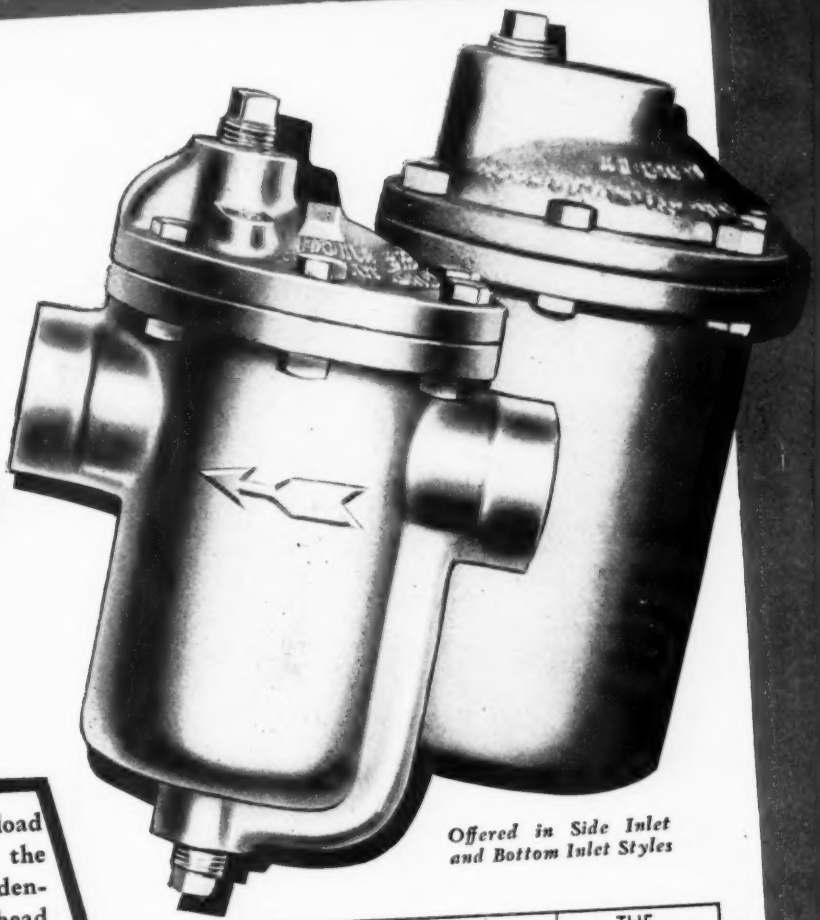
The importance of protecting industry against waste has been recognized by proper authorities and to this end all necessary maintenance and repairs are authorized.

Pound for pound, few items of plant equipment are so important to FUEL CONSERVATION as the traps used to prevent steam loss in power, process, and heating operations. MAKE SURE YOUR TRAPS ARE IN GOOD REPAIR.

ARMSTRONG MACHINE WORKS
812 Maple Street
Three Rivers, Mich.

ARMSTRONG *Inverted Bucket*

... begins HERE



Offered in Side Inlet and Bottom Inlet Styles

NO STEAM LOSS

The Armstrong Trap is suitable for variable load conditions and no steam passes through the discharge orifice even when there is no condensate load. No cooling legs are required ahead of an Armstrong Trap. Condensate is discharged as fast as it forms.

TIGHT-CLOSING VALVE

Armstrong traps feature the famous "Free Floating" valve: no fixed pivots . . . virtually no wear . . . no throttling of orifice, no wire-drawing . . . snap action closing . . . hemispherical valve seats perfectly every time.

FAST HEATING

Quick condensate removal and automatic air elimination make unexcelled heating speed possible for every installation. Maximum leverage makes it possible to use large discharge orifices. Blast type buckets available for extra-fast air removal. *Ask for latest catalog.*

FEATURES Operating Engineers want in Steam Traps:	THE ARMSTRONG STEAM TRAP:
1. Ability to draw off air.	✓YES
2. Ability to handle hot condensate.	✓YES
3. Ability to handle all ordinary sediment and sludge.	✓YES
4. Freedom from wire-drawing in orifice.	✓YES
5. No steam loss for any load condition.	✓YES
6. Ability to hold tight against vacuum.	✓YES
7. Freedom from friction and wear.	✓YES
8. Small size — light weight.	✓YES
9. Simple construction.	✓YES
10. Large capacity.	✓YES

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production

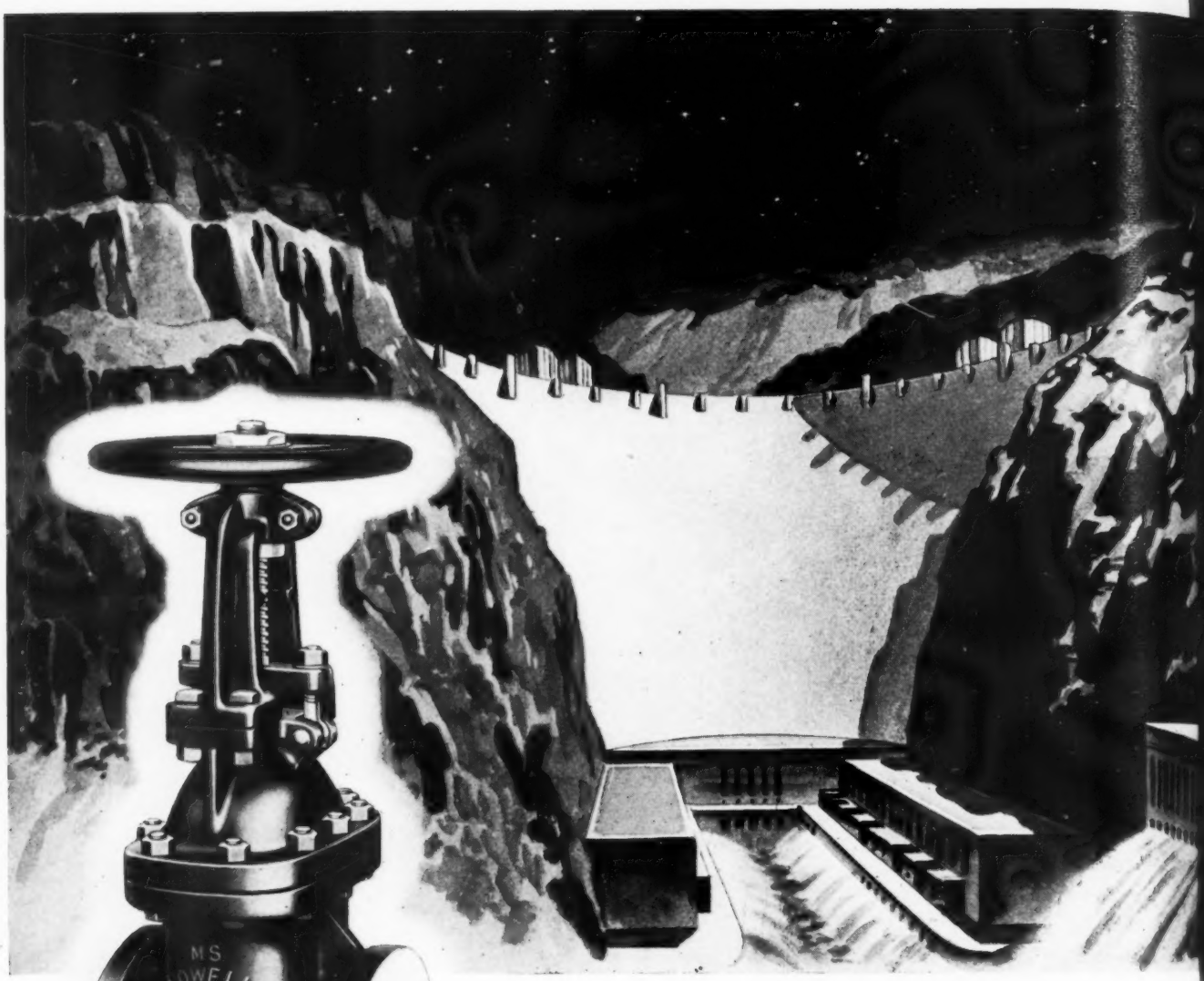


Fig. 1793—A large size Iron Body Bronze Mounted Gate Valve with flanged ends, outside screw rising stem, and taper wedge solid disc. Made in sizes 2″ to 30″ inclusive, for 125 pounds W. P.

Also available with taper wedge double disc—Fig. 1444—sizes, 2″ to 12″, inclusive.

Millions of human beings depend on Boulder Dam to perform the function for which it was designed.

In the Power field, valves perform many important functions. And above all—day in and day out—they must perform these functions dependably.

For nearly a century Powell Engineering has been designing valves to meet all requirements for precise flow control under any and all conditions. And Powell engineering, Powell materials and Powell workmanship have made these valves above all things—*dependable*. That's why today the flow through so many of the power lines of America is controlled by Powell Valves.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

POWELL

DEPENDABILITY

Fig. 1708—Bronze Globe Valve, with screwed ends, union bonnet, renewable seat and regrindable, renewable hard bronze semi-cone plug-type disc. Can be repacked under pressure when wide open. Sizes, ¼″ to 3″, inclusive, for 200 pounds W. P.

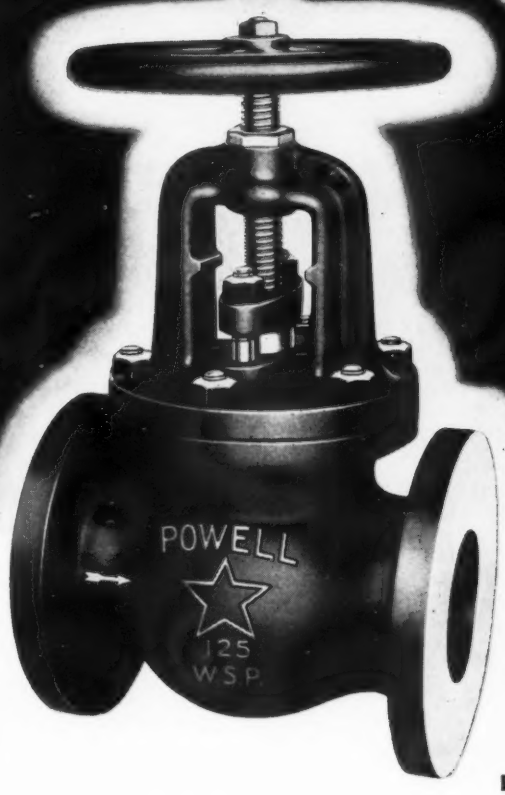


Fig. 241—An Iron Body Bronze Mounted Regrinding Globe Valve with flanged ends, outside screw rising stem and bolted flanged yoke. Made in sizes 2″ to 12″, inclusive, for 125 pounds W. P.

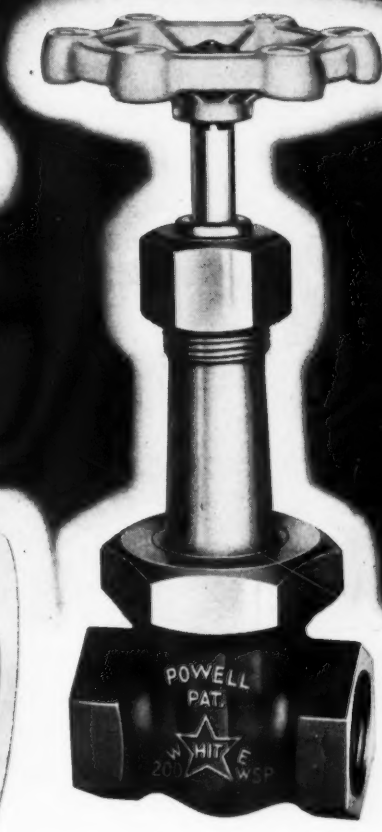
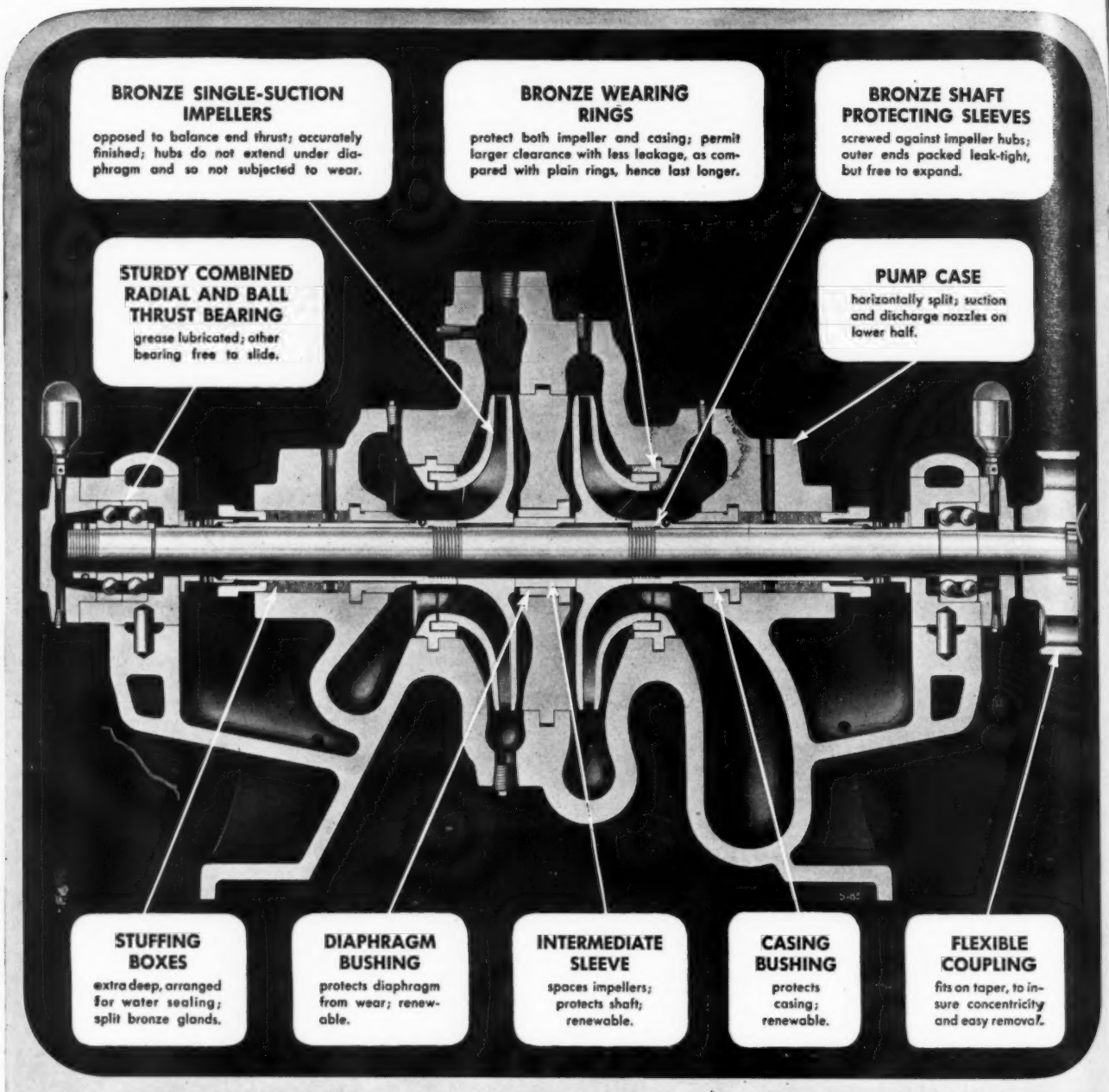


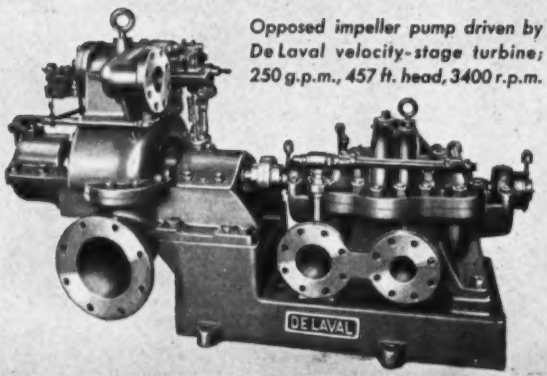
Fig. 375—Bronze Gate Valve, with screwed ends, union bonnet, inside screw rising stem, and special hard bronze disc. Can be repacked under pressure when wide open. Sizes, ¼″ to 3″, inclusive, for 200 pounds W. P.

The complete line of Powell Valves includes Globes, Angles, Gates, Checks, Reliefs, Y's, Non-returns, etc., in bronze, iron, steel, pure metals and special alloys to handle ever-increasing pressures and temperatures.

VALVES


BRONZE SINGLE-SUCTION IMPELLERS
opposed to balance end thrust; accurately finished; hubs do not extend under diaphragm and so not subjected to wear.
BRONZE WEARING RINGS
protect both impeller and casing; permit larger clearance with less leakage, as compared with plain rings, hence last longer.
BRONZE SHAFT PROTECTING SLEEVES
screwed against impeller hubs; outer ends packed leak-tight, but free to expand.
STURDY COMBINED RADIAL AND BALL THRUST BEARING
grease lubricated; other bearing free to slide.
PUMP CASE
horizontally split; suction and discharge nozzles on lower half.
STUFFING BOXES
extra deep, arranged for water sealing; split bronze glands.
DIAPHRAGM BUSHING
protects diaphragm from wear; renewable.
INTERMEDIATE SLEEVE
spaces impellers; protects shaft; renewable.
CASING BUSHING
protects casing; renewable.
FLEXIBLE COUPLING
fits on taper, to insure concentricity and easy removal.

DE LAVAL *OPPOSED* IMPELLER PUMP



Opposed impeller pump driven by De Laval velocity-stage turbine; 250 g.p.m., 457 ft. head, 3400 r.p.m.

In this pump the two single-suction impellers have their suction inlets facing outwardly, thus balancing the pump hydraulically and requiring only two pairs of wearing rings. High efficiency is thus combined with simple construction. Pumps built in capacities up to 1500 g.p.m. and for heads up to 800 ft. Ask for Catalog P-3226.

DE LAVAL STEAM TURBINE CO. . . TRENTON, N. J.

CONTENTS PAGE

POWER

A McGRAW-HILL PUBLICATION

MARCH, 1943 VOLUME 87 NUMBER 3

Copyright 1943, by McGraw-Hill Publishing Co., Inc.

FUELS AND FIRING
STEAM GENERATORS
STEAM TURBINES AND ENGINES
STEAM-POWER AUXILIARIES
HYDROELECTRIC POWER
DIESEL AND GAS ENGINES
PUMPS AND COMPRESSORS
PIPING, VALVES AND FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
INSTRUMENTS AND CONTROL
STEAM SERVICES AND HEATING
TRANSMISSION, LUBRICATION
OPERATION AND MAINTENANCE
POWER MISCELLANY

N O WYNKOOP, *Publisher*

PHILIP W SWAIN, *Editor*

Associate Editors: F A ANNETT
S A TUCKER L N ROWLEY JR

Assistant Editors:
E W FELLER G A KEATES

Paul Wooton, *Washington*
G C Tenney, *San Francisco*
H S Knowlton, *Boston*

Business Manager
E J TANGERMAN

From QMED to O/C to Marine Engineer 64
Simple rules for checking chains and hooks 67
Old unit modernized provides dc auxiliary power . . 68
Operation key to boiler mainntenance 71
Short words carry a punch that long ones don't 74
Maximum aid to war effort AIEE theme 76
Steam helps make synthetic rubber here 80
Pumps send oil east through "Big Inch" Pipeline . . . 82
Proper gear selection eliminates troubles 83
The ABC's of industrial scrap collection 87
How to calculate regenerative heat balances 88
Electronics control gives wide operating range 92
Discussing nerves in the Old Chief's day 94
Power Clinic—emergency problems answered 95
Construction and operation of rotary pumps 99
Consult manufacturers oftener for belt advice 102

THE OPERATING ENGINEER

How to get longer life from packing 103
Questions and Answers for power engineers 114
Practical Aids . . . . . 106b Readers' Problems . . . 110
How to repair belts . 120 Data Sheet 130

OTHER DEPARTMENTS

Engineers' Books . . . . . 124 Power Lines 126
New Plant Equipment . 132 George Edwards 134
New Construction . . . . 158 New Bulletins 165

Cover photo courtesy Allis-Chalmers Mfg. Co.

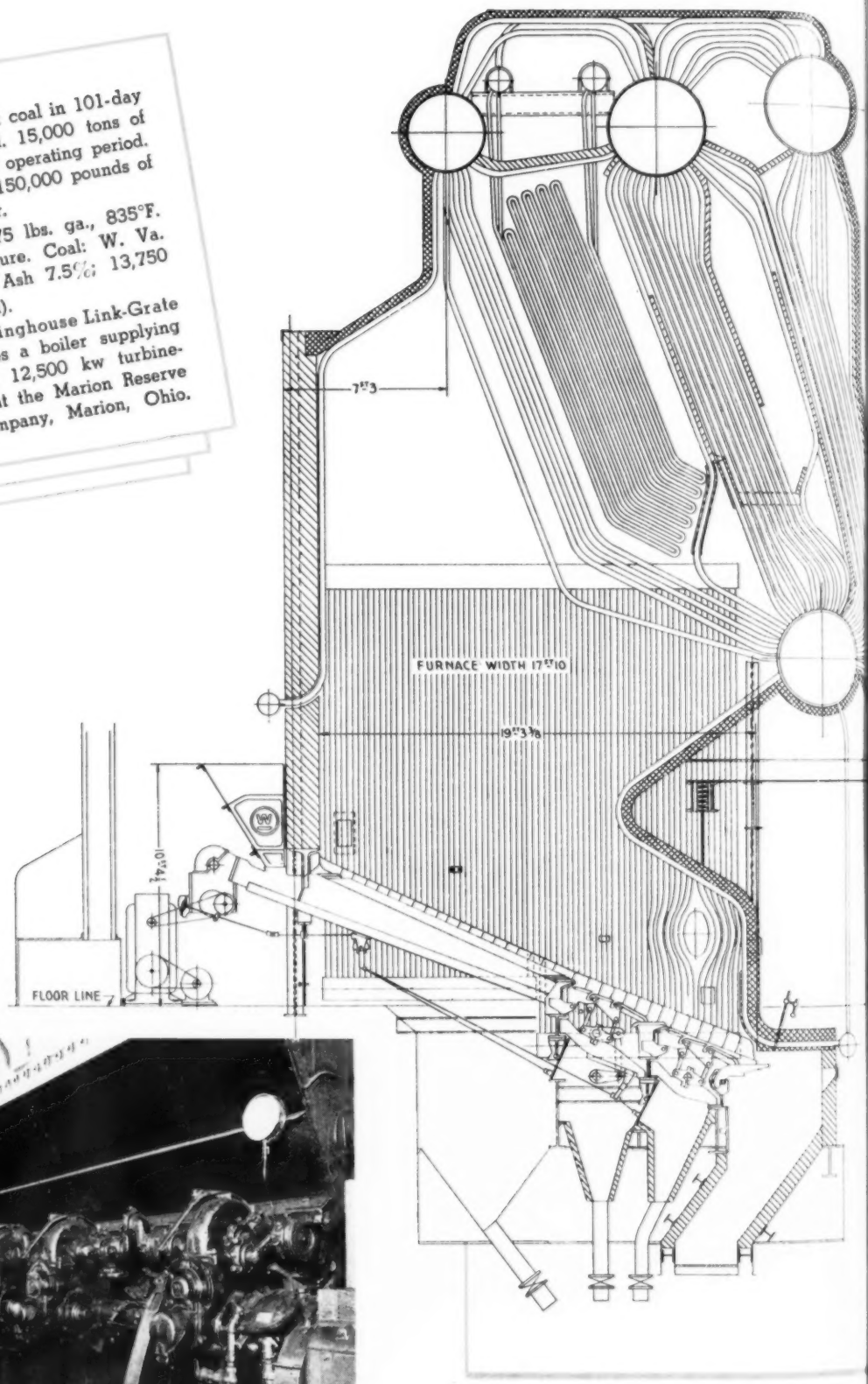
James H McGraw, Founder and Honorary Chairman; James H McGraw Jr, President, Howard Ehrlich, Executive Vice-President; Mason Britton, Vice-President; B R Putnam, Treasurer, J A Gerardi, Secretary; J E Blackburn Jr, Director of Circulation • District Managers: New York, S H Quarles; Philadelphia, C R Long; Cleveland, F B Godley; Chicago, C Boughton; Boston, C L Morton; St Louis, G G Sears • Editorial and Executive Office: 330 West 42nd St, New York, N. Y. • Publication Office: 99-129 North Broadway, Albany, N. Y. • Cable Address: "McGrawhill, New York" • District Offices: Chicago, 520 North Michigan Ave; San Francisco, 68 Post St; Washington, National Press Bldg; Philadelphia, 16 South Broad St; Cleveland, 1510 Hanna Bldg; Detroit, 2-144 General Motors Bldg; St Louis, 1066 Paul Brown Bldg; Boston, 1427 Statler Bldg; Atlanta, 1011 Rhodes-Haverty Bldg; London, Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index, at public libraries

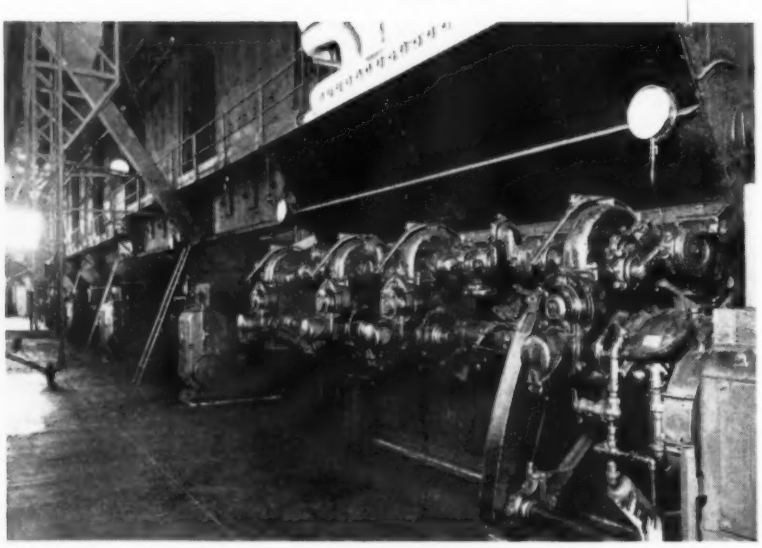
Sustained overload

14,000 tons of coal in 101-day operating period. 15,000 tons of coal in 117-day operating period. Average load: 150,000 pounds of steam per hour.

Pressure: 875 lbs. ga., 835°F. total temperature. Coal: W. Va. Vol. 33.5%; Ash 7.5%; 13,750 BTU. (as fired).

This Westinghouse Link-Grate Stoker serves a boiler supplying steam to a 12,500 kw turbine-generator at the Marion Reserve Power Company, Marion, Ohio.





Westinghous

PLANTS IN 25 CITIES... OFFICES EVER

stoker capacity TO MATCH

WAR PLANT 'ROUND-THE-CLOCK OPERATION

That's the kind of continuous trouble-free performance provided by the Westinghouse Link-Grate Stoker

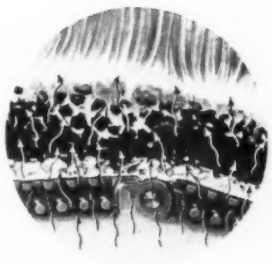
Typical of Link-Grate Stoker performance is the case of the Marion Reserve Power Company installation, located in the heart of the country's coal-burning area, at Marion, Ohio. This stoker has been operating continuously for 101 days, at an average load of 150,000 pounds of steam per hour, serving an 875-pound, 835°F. boiler.

Installed in 1941, this stoker *has never been the cause of boiler down-time;* it is periodically serviced only at three or four-month intervals. Such operation is representative of the results experienced by Link-Grate users throughout the coal-burning belt. Visit your nearest Link-Grate operator and see for yourself.

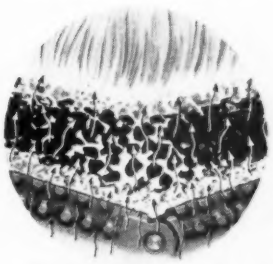
LINK-GRATE MOTION keeps the burning fuel in constant progression, forming a porous fuel bed that burns evenly and thoroughly. An undulating, wave-like motion keeps ash accumulations small in size. Continuous ejection of ash off the ash discharge plate eliminates periodic dumping and irregular burning, thus assuring *top operating economy.*

J-50429

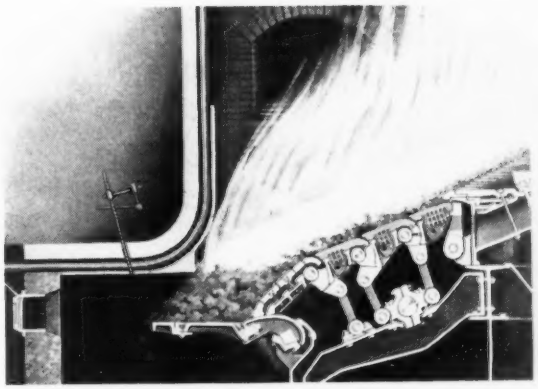
GET THE PERFORMANCE FACTS — the economy figures. Send for these interesting fact books on Link-Grate Stokers: Bulletin 3039 (multiple retort); 2196-A (single retort), Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.



GRATES UP—Fuel bed broken, thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.



GRATES DOWN—Fuel bed made porous for uniform flow of gases throughout entire combustion zone—continuously conveyed toward the dump grates.



WESTINGHOUSE

Link-Grate **STOKERS**

The Answer is "YES!"

Genuine WROUGHT IRON WELDING FITTINGS ARE being made!

With every pound of metal allocated on the basis of greatest need, conservation is naturally the aim of every thoughtful engineer. This is reflected in today's specifications, which show the care given to designating the most durable available material in each individual service.

Because of its outstanding record in combating the severe corrosion encountered in many piping applications, wrought iron is extensively specified. In some instances where welding is employed, however, substitution of fittings made of ordinary materials has been made or suggested, on the excuse that genuine wrought iron welding fittings were not available.

Such a substitution is like connecting two hoist chains with a clothes-line, and may cancel out all the benefits of the specifiers' care in selection. The facts are that genuine wrought iron welding fittings have been, and are being produced.

A. M. Byers Company does *NOT* make these fittings, but *DOES* supply wrought iron to fitting manufacturers.

We urge that you get in touch with (1) a Byers Field Service Engineer, (2) the nearest Byers District Office, or (3) the Byers General Office in Pittsburgh for definite information on available sources of supply of genuine wrought iron welding fittings. By so doing, we will put you in touch with these sources and you will therefore have authoritative information to go on rather than rumor or heresay.

Please do not hesitate to write, if we can help you.

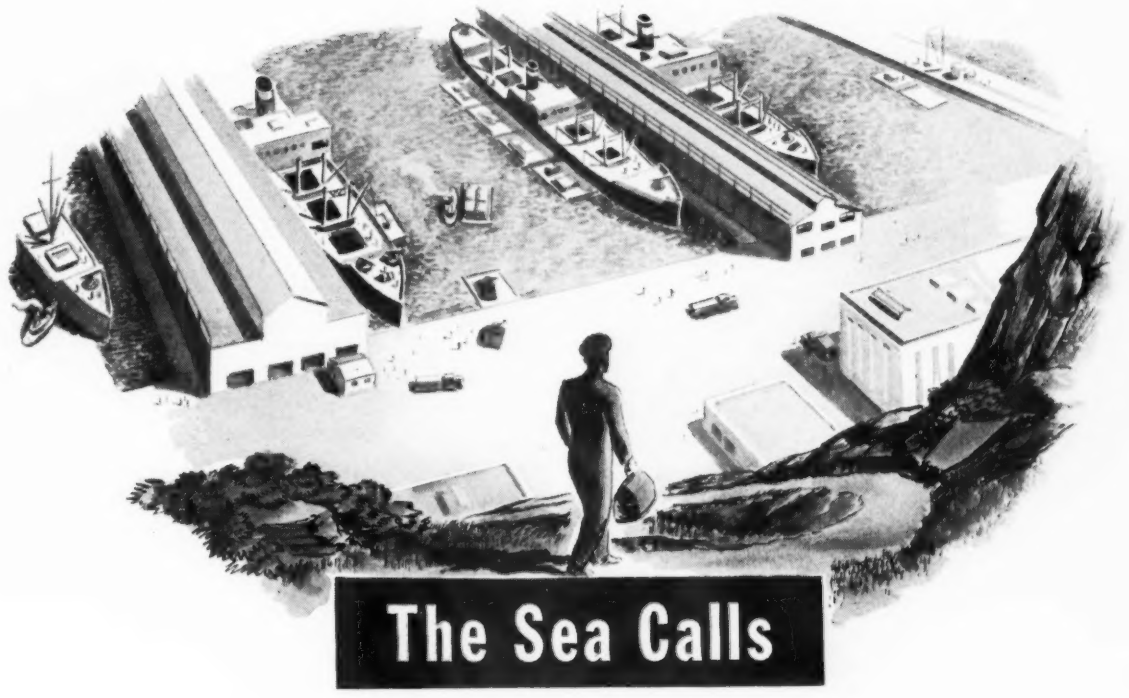
A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
STEEL TUBULAR PRODUCTS

POWER

Established 1882 • PHILIP W SWAIN, Editor



The Sea Calls

THE LONG-PREDICTED CRISIS IS HERE—a grave shortage of seagoing engineer officers to man more than a million tons of new merchant ships each month. These ships must sail or we can't win the war.

In this hour of national peril, the government turns to the men who know how. First are the ex-marine engineers. Next, the thousands of land-plant power men—chief engineers, assistants, watch engineers. It doesn't take long to gear their mechanical know-how to the peculiarities of seagoing power equipment.

Because these men, typical POWER readers, can serve America more effectively than any other group in this crisis, we present (page 64) practical suggestions for readers who want to know more about going to sea as engineer officers.

Briefly, here are points to remember: Including transport service, the merchant marine must add another 2000 licensed engineers by summer. The stationary engineer can get his marine certification in four to seven months.

Steps are easy! Write or visit any one of four main recruiting stations of the War Shipping Administration (chart, page 65) or any of the several port offices. Describe your license and tell where and how long you have worked in stationary power plants. Aside from an acceptable license you must have reasonably good health and two years of actual responsible power experience. For robust men there is no age limit.

If you satisfy the recruiting officer's requirements you will be transported free to a training ship to learn marine engine-room methods in one month of short runs. Then you go to sea for one round trip as Junior Third Assistant (unlicensed). Next you sit for your examination for regular Third Assistant Engineer license, with officer commission as Ensign, USMS.

Incentives include good pay, overtime and bonuses, $5000 free war-risk insurance, quick promotion, the chance to serve your country as completely as any other sailor or soldier.

But the job has its dark side, too. The submarine menace has not yet been licked. Casualty lists will continue to include many engineers because Hitler's "wolf packs" will make their most desperate drive this year. The simple fact is that the merchant-marine engineer serves in the "front lines" just like Navy sailors, soldiers and marines. With them his lot is "blood, sweat and tears" and what glory may drift his way.

But there is one essential difference. More than any other service, the merchant marine is the right front line for the power engineer who wants to make his skills count to the limit for victory.

Photos by R L Perry, U.S. Maritime Services

Training strategy originates at headquarters where Comdr J D Bosler and Lieut Comdr S C Fraser plan every minute of students' waking time during four months study

From QMED to O/C to MARINE ENGINEER

With 14 months in a ship engine room behind him a seaman can step up to a licensed officer berth after four months of technical schooling in marine engineering at Maritime Service officer school at Fort Trumbull

▶ IN THESE DAYS WHEN DIFFICULT things are done at once and impossible ones take a little longer, it requires only a month or so to make a ship, but takes four times as long to train an engineer to run its machinery. With more than a thousand new ships coming off the ways in 1943 and the critical shortage of marine engineers already a major problem, training and recruiting must proceed at an ever more rapid rate.

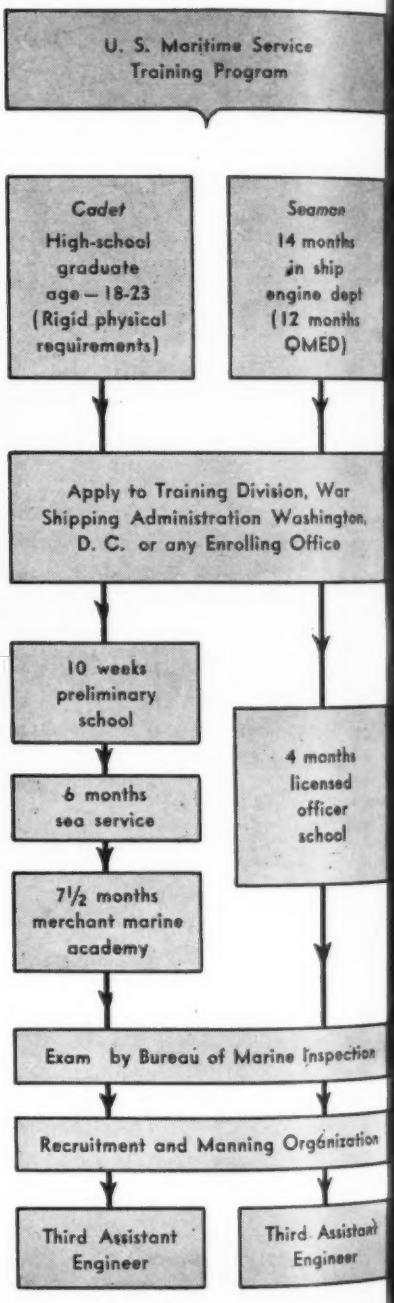
The War Shipping Administration is the government agency charged with providing an adequate supply of men and officers to take every available ship out of port on time. Its Division of Training has reduced the officer training program of young men from four years to 16 months (POWER, February, 1943, page 66), and set up two additional schools at Fort Trumbull, Conn. and Alameda, Cal. to qualify seamen and members of ship engine departments for licenses after four months of intensive "officer candidate" training.

To enter either of these schools, candidates must show discharge papers totaling at least 14 months at sea of which at least 12 months has been spent as QMED (qualified member of engine department) on steam or motor vessels the size of a "laker" or larger. The four-months' shore training period at either school counts as equivalent of sea time toward the 18 months required for Third Assistant Engineer's license.

Sea time in the Navy or Naval Reserve is accepted provided the candidate obtains a transcript of naval service from the Bureau of Naval Personnel in Washington, D. C. Time spent ashore, even in naval service, cannot be counted.

Approved applicants are enrolled

FROM 6 CLASSES


U. S. Maritime Service Training Program
Cadet
High-school graduate age — 18-23 (Rigid physical requirements)
Seaman
14 months in ship engine dept (12 months QMED)
Apply to Training Division, War Shipping Administration Washington, D. C. or any Enrolling Office
10 weeks preliminary school
6 months sea service
7½ months merchant marine academy
4 months licensed officer school
Exam by Bureau of Marine Inspection
Recruitment and Manning Organization
Third Assistant Engineer
Third Assistant Engineer

immediately in the Maritime Service in the grade of Chief Petty Officer (acting) and receive $126 per month salary during training. Maritime Service provides transportation to the school, quarters, meals, uniforms, textbooks and other educational materials.

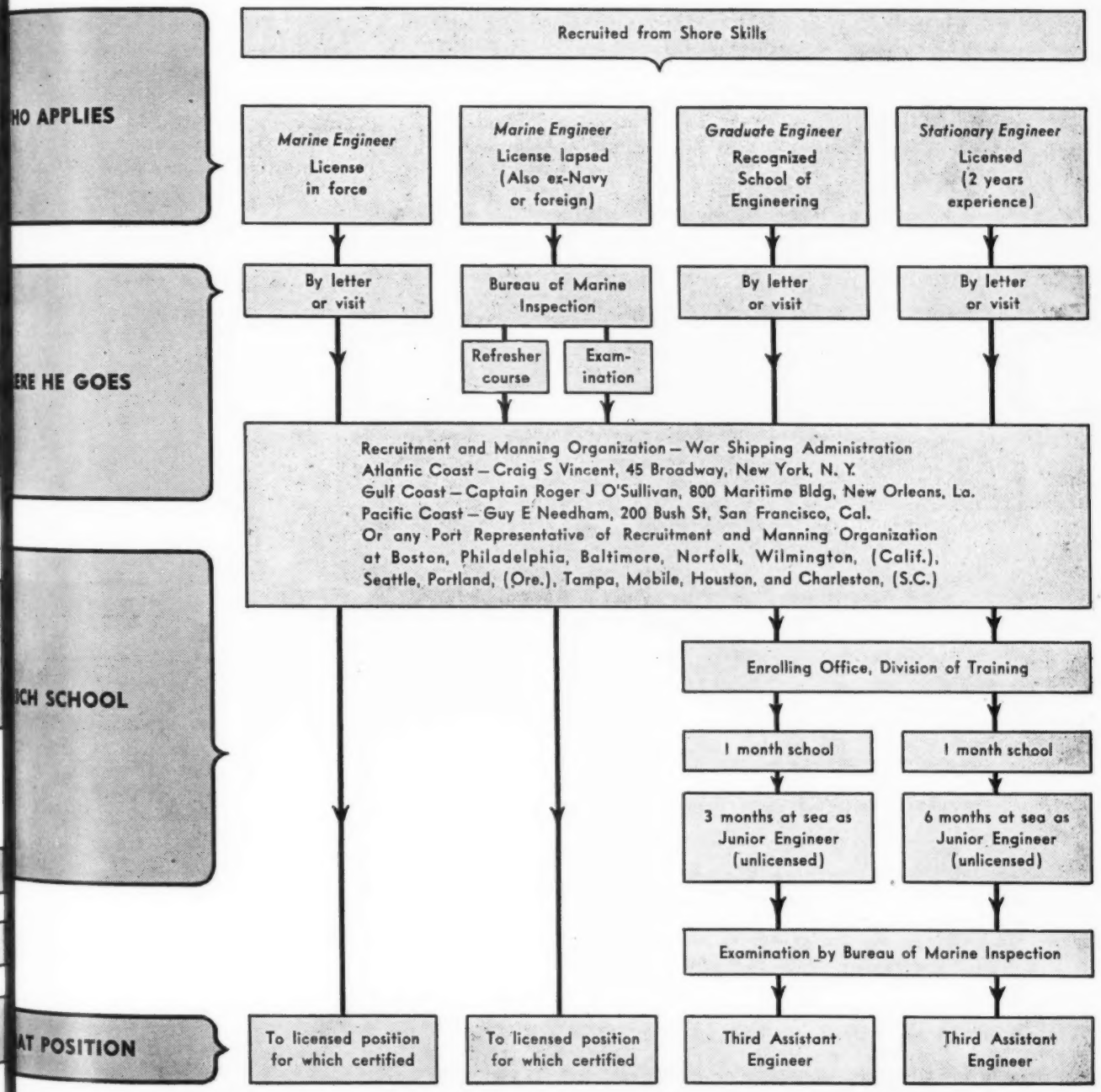
Under leadership and instruction of commissioned officers in the U. S. Naval Reserve and U. S. Maritime Service, all experienced in marine engineering or navigation, the applicants for engineer licenses not only study the why and how of steam engines, turbines, boilers and internal-combustion engines but also are required to master practical arithmetic, ship electricity, mechanical drawing, ship rules and regulations, first aid and machine shop practice. In addition, they carry on lifeboat, gas-mask, safety-lamp, oxygen-breathing-apparatus and kindred drills that are part of a safe life at sea for all men in wartime.

Typical of the backbone of 30 class hours a week are basic 3-hour periods on operation and maintenance of reciprocating steam engines, such as are used in Liberty ships, modern marine turbines and their gear arrangements, oil-fired boilers of both firetube and watertube types, and diesel-engine operation for both main-propulsion and auxiliary service.

With visual aids such as motion pictures and slide films, the intimate workings of evaporators, pumps, steering mechanisms are brought home to men who already have known the practical "feel" of operation and maintenance of the equipment aboard ship. Two authentic Liberty ship oil-fired watertube boilers (for heating the reservation buildings) also provide realistic background for instruction.

From classroom lectures and reference book study, men have to find answers to such questions as "What is a soft patch?", "Of what is a fusible plug made and at what temperatures does it melt?". They learn proper procedure

OF CIVILIAN LIFE COME MARINE ENGINEERS


HO APPLIES
ERE HE GOES
ICH SCHOOL
AT POSITION
Recruited from Shore Skills
Marine Engineer
License in force
Marine Engineer
License lapsed (Also ex-Navy or foreign)
Graduate Engineer
Recognized School of Engineering
Stationary Engineer
Licensed (2 years experience)
By letter or visit
Bureau of Marine Inspection
Refresher course
Exam-ination
By letter or visit
By letter or visit
Recruitment and Manning Organization — War Shipping Administration
Atlantic Coast — Craig S Vincent, 45 Broadway, New York, N. Y.
Gulf Coast — Captain Roger J O'Sullivan, 800 Maritime Bldg, New Orleans, La.
Pacific Coast — Guy E Needham, 200 Bush St, San Francisco, Cal.
Or any Port Representative of Recruitment and Manning Organization at Boston, Philadelphia, Baltimore, Norfolk, Wilmington, (Calif.), Seattle, Portland, (Ore.), Tampa, Mobile, Houston, and Charleston, (S.C.)
Enrolling Office, Division of Training
1 month school
1 month school
3 months at sea as Junior Engineer (unlicensed)
6 months at sea as Junior Engineer (unlicensed)
Examination by Bureau of Marine Inspection
To licensed position for which certified
To licensed position for which certified
Third Assistant Engineer
Third Assistant Engineer

Fort Trumbull steam supply comes from two authentic Liberty ship boilers with typical marine pumps, evaporator and auxiliaries. Lieut Johnson teaches oil burners, preaches cleanliness and debunks superheat, drawing on the lore of years at sea

In the machine shop, every man masters drill press, lathe and shaper by actual cuts to close tolerances. On this piece (note blueprint) he gets point-by-point credit for each of 12 dimensions correctly turned, but is also encouraged to think for himself

for starting and "securing" boilers, allowable repairs, methods of boiler inspection, functions of safety devices, how to adjust diesel injection systems and the thousand other details that an engineer on watch must have at his fingertips.

In the machine shop, fundamentals of drill press, lathe and shaper are stressed by requiring each man to make several small parts to close tolerances. Each officer candidate drills the equivalent of an 8-bolt flange circle, cuts standard and square threads, machine tapers and learns some of the tricks that can be performed with a lathe when necessity arises.

At the completion of his four months at Fort Trumbull, or Alameda, each man immediately sits for his qualifying license under the direction of representatives of the U. S. Coast Guard Bureau of Marine Inspection. If successful, as most are, he takes his place on Recruitment and Manning Organization lists for the next available ship. Under present conditions, particularly in regard to engineers, he has not long to wait! Several hundred well-trained and competent "Thirds" are already standing their regular watch after graduation from Fort Trumbull.

While cadet and officer training schools are providing a steadily increasing supply of engineers, ships are being launched and commissioned at an even faster rate. The American merchant marine faces the greatest task in its history. It must transport seven tons of equipment and supplies for each fighting man sent across the ocean. In addition, it must carry vast quantities of food and material to United Nations allies to fulfill our promise of lend-lease aid to every embattled corner of resistance against Axis aggression. In addition, experienced officers and crews must be supplied for transport of reserves and additional men.

Stationary Engineers

Recruiting of every available experienced marine engineer has been under way for some time. While a number have already returned to sea and more will gradually be available, the number of physically able men not already holding key shore positions is definitely limited. Training programs, stepped up to the most rapid pace consistent with safety of ship and crew, require definite periods of schooling before men become available. Additional recruiting procedures are soon to be extended to stationary engineers.

Facilities of the Division of Training at certain of its schools will be extended to licensed stationary engineers with at least two years of well-grounded experience ashore. While arrangements have not yet been completed, information can be obtained from any Enrolling Office of the U. S. Maritime Service or Recruitment and Manning Organization.

After registering with the enrolling officer, a stationary engineer takes a one-month course in engine-room methods on board a training vessel of the USMS in New York Harbor. While in training, he receives $126 per month salary plus maintenance. At the completion of this brief study, he boards ship as a Junior Third Assistant Engineer (unlicensed). After three to six months' sea duty (or one complete voyage) he takes the regulation license

(*Continued on page* 136)

Watch Weakest Link

Authoritative tips on inspecting chains and hooks used for hoists or slings, by W Elwood Rossnagel, safety engineer

▶ONCE UPON A TIME chains hoisted all loads too heavy for manila rope. Now, wire rope does most of the high-speed lifting; chain is better adapted to short-haul heavy work in hoists and slings. Steel chains can resist wear, corrosion and abuse better than wire rope, particularly in the severe service demanded of slings.

Wire rope is composed of 114 or more individual wires all of which must fail before the load falls. Each link of a chain has but two sides and the failure of either side of any link would cause the chain to fail and the load to drop. For this reason every link deserves careful inspection. Since the welds of a hand-forged chain depend largely upon the human element, a factor of safety of not less than five should be allowed when installing a new chain.

When a wire rope becomes fatigued from severe service, wires break one after another over a long period of time so that an inspector has ample opportunity to discover the weakened condition of the strands. Even under severe overload, wires and strands break progressively with resultant noise over a period of perhaps several seconds before complete failure occurs. Men handling the load have at least a brief time to get to safety before load drops. Chains, on the other hand, almost always fail without warning—one loud snap from the broken link almost merges with the crunch of fallen load.

Inspection Routine

From a safety standpoint, a competent inspector should check chains that are in normal daily use at least once a month. A weekly going over is recommended to avoid accidents when chains handle loads such as hot metal in foundries. One aid to routine inspection is a serial numbering system in which every chain has a number stamped into the end link or ring, or perhaps on a metal tag attached to the chain.

Sling chains need annealing or normalizing at least once a year. Crane and hoist chains in active service can go up to two years without similar heat treatment. Good practice calls for discarding chains after six annealings.

Improper annealing can be worse than none at all. Unless knowledge of proper procedure and the necessary facilities are available at a plant, chains should be returned to the manufacturer for heat treatment.

Periodic (monthly) inspections should include a careful looking over of the entire length of chain with particular attention to amount of wear where adjacent links bear upon each other. Fig. 1 gives approximate breaking strength that a crane chain can be expected to develop when the metal in the link-ends has been reduced below original thickness. *Caution:* A safety factor of at least five should be used in determining safe working load.

In no case should chains worn more than 25% of original thickness be used for hoisting. In addition, the inspector should pay particular attention to the condition of the welds; ends of scarfs should be watched for cracks or separation of the metal.

Gouges or cuts in a link are cause for cutting open and removing a link if the cross-section is materially reduced. Watch all sharp nicks and cuts because cracks usually start at these spots. Remove without question any link that shows evidence of cracking. If a crack is suspected, soak the link in thin oil, wipe dry and apply a coating of powdered chalk or talc. After

(*Continued on page* 136)

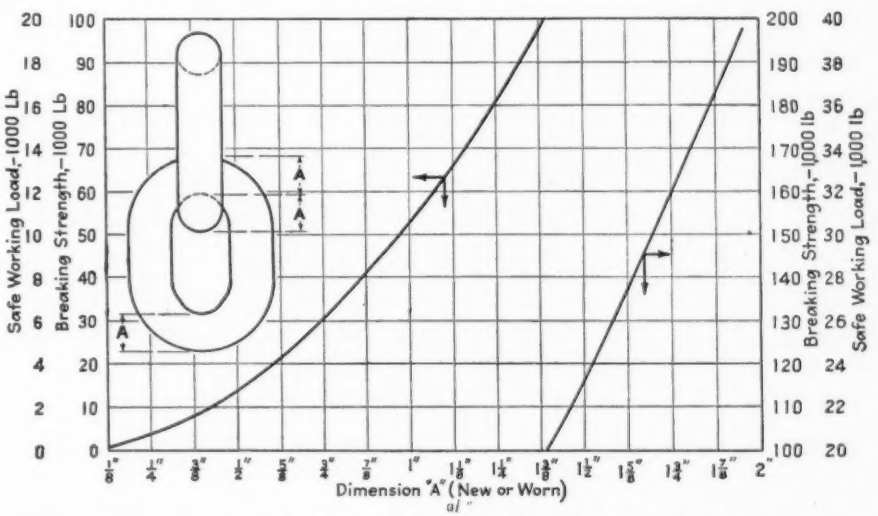


Fig. 1—Approximate breaking strength of sling or hoist chain when original dimension of link ends has been reduced (never more than 75%) to worn dimension *A*

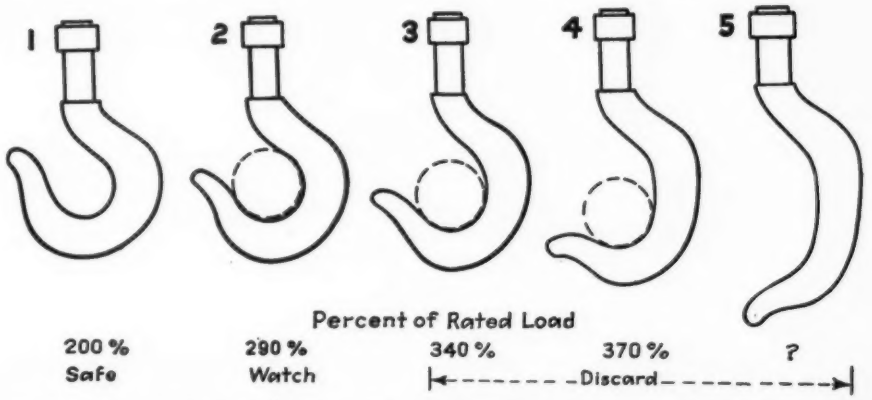


Fig. 2—Overloading hoist hook spreads tongue away from neck. Discard hook if deformation exceeds that of No. 2 which can be reforged and annealed

Adapting an Auxiliary T

R G Baker, DeLaval Steam Turbine Co, describes adaptation of a 1925 auxiliary dc turbine-

▶ WHEN A STEAM-POWER PLANT is converted to operate at higher pressure, old steam-driven auxiliaries are frequently scrapped. Even when some of the low-pressure boilers survive, operation of the low-pressure auxiliaries does not result in maximum plant economy because of the secondary loading ordinarily assigned such machines and because of the inherently higher efficiency of higher-pressure machines for the same work.

In a large station, on the other hand, house generators, or other auxiliary units of similar size, converted to use high-pressure steam, can compete with the main units in supplying power. The latter would of necessity be charged with the losses in transformation, especially for dc speed control of boiler-feed and circulating pumps, draft fans, stokers, cranes, conveyors, and the like.

The Detroit Edison Company uses dc house-service units extensively. In 1925 they installed five dc geared-turbine units of the type shown in Fig 1, to serve six 50,000-kw turbine-generators in the Trenton Channel plant and three similar units to serve the original three 50,000-kw turbine units in the Delray plant. All these house generators, designed to carry 25% overload two hours and 50% overload one-half hour, operated with steam at 375 psi, 700 F and exhaust at 1 in. Hg abs. Turbine ends were compound, arranged in separate high- and low-pressure sections. Each section was coupled to a pinion engaging a double helical gear driving the dc generator at 375 rpm. High-pressure sections controlled steam flow to the units, as no valves were provided for low-pressure stages either on turbines or in the crossover connection.

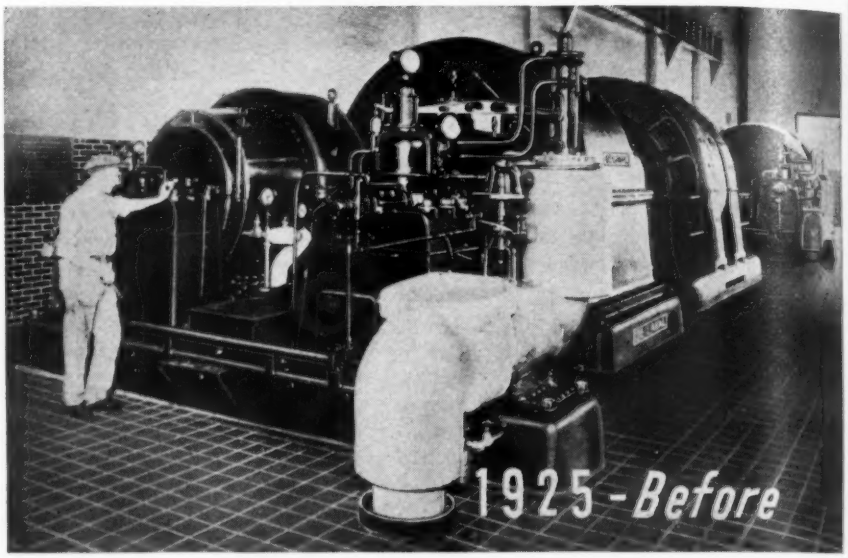


Fig. 1—Eighteen years ago this 4000-kw compound geared turbine was one of five units installed at the Trenton Channel plant. It used steam at 375 psi gage and 700 F

Extraction for Heating

To supply steam for building heating, extraction was provided from the sixth stage of Trenton units and from the fourth stage of Delray units. No positive extraction control was provided, however, and pressure at the extraction outlet, when bleeding 15,000 lb per hr, varied from 65 psi g at rated load down to atmospheric pressure at 20% load. An automatic pressure-regulating valve in the extraction line reduced the extracted steam pressure to about 10 psi g for use in the building-heating system. In actual operation, machine loadings were such that it was often impossible to bleed steam from the turbine because pressure at the extraction stage was too low.

In 1937, Delray capacity was increased by installing additional main units each of 75,000-kw capacity; three are now in service. Throttle steam conditions of 815 psi g, 900 F were selected for normal operation of these units on the basis of successful operation at 600 psi g, 825 F at Conners Creek and results obtained on an experimental high-temperature unit at Delray.

As Trenton Channel had some extra house-service-generator capacity, DeLaval Steam Turbine Co, builder of the original machines, was asked to rebuild one of the Trenton Channel units for use with Delray's new steam conditions. In 1941, they substituted for the original 375-psi-g 700-F 11-stage high-pressure element a new high-pressure turbine consisting of 16 stages designed for maximum throttle conditions of 850 psi g, 925 F, without alterations in the low-pressure turbine or in the reduction gears. Needed were a new automatic bleeder control in the crossover between high- and low-pressure sections and a new baseplate for supporting both the old low-pressure and the new high-pressure turbines. While the changeover to higher-pressure steam alters the division of load between high- and low-pressure turbines, increasing by about 20% at full load the output of the high-pressure turbine, the resulting gear-tooth pressure is not too high for the conservatively designed gears.

In the rebuilt unit, Fig. 2, steam enters the turbine through a hand-wheel-operated throttle, shown in Fig. 3 on page 70. This valve is fitted with a quick-closing device which shuts off flow of steam instantly when released by the emergency trip mechanism. Mounted across the top of the steam chest is a row of five admission valves of single-seat unbalanced type.

Control Valves

Each valve has an internal secondary pilot valve which is unseated first to bypass steam through ports in the side of the main valve, thus reducing the pressure differential acting on the latter. Each valve controls the steam supply to a separate group of first-stage nozzles. One after the other the valves are opened by a cam-actuated lifting bar, and closed by it in reverse order. The camshaft is rotated through a rack-and-pinion mechanism by a hydraulic cylinder and piston, which receives oil under governor control.

Turbine for Higher Pressure

generator for higher pressure and temperature alongside new main generating equipment

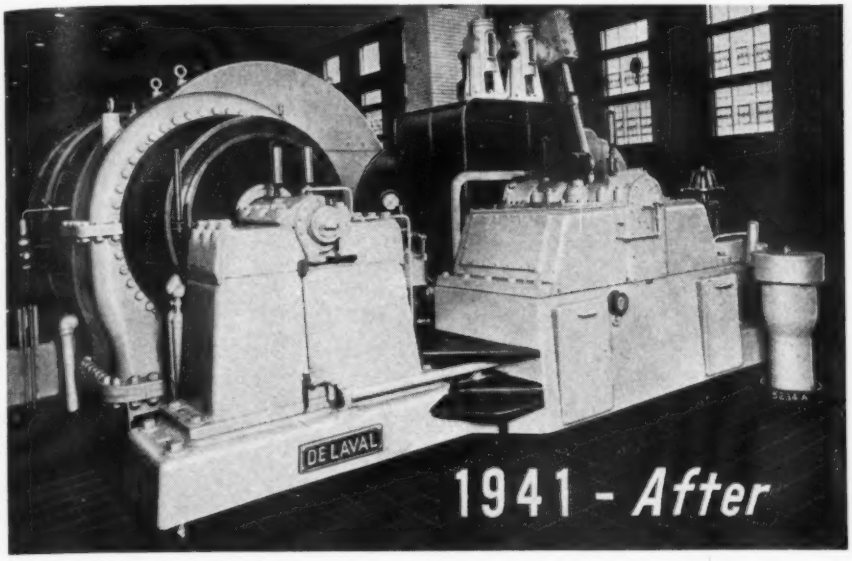


Fig. 2—Turbine as rebuilt and installed in Delray Station in 1941 to use steam at 815 to 850 psi gage and 900 to 925 F. The new high-pressure section is at the right

An overload valve which bypasses steam from the first to the sixth turbine stage avoids building up excessive pressure in the first stage under overload conditions. The overload valve is cam operated through a lever and opens simultaneously with the fourth and fifth nozzle-control valves.

The centrifugal governor, along with its hydraulic cylinder, is inside the pedestal beneath the high-pressure turbine, out of sight and protected from dust and mechanical injury. Inclosing oil piping in the pedestal makes the machine look trim and shields oil lines from hot surfaces of turbine and steam piping.

A positive automatic extraction control, gained through rebuilding, eliminates the shortcomings of the original non-automatic arrangement. The redesigned unit is built for bleeding 1500 lb per hr from the crossover piping between high- and low-pressure turbines at a nominal pressure of 10 psi g. A valve that responds to changes in crossover pressure now admits steam to the low-pressure turbine from the crossover. When pressure tends to fall below the desired value because of a change in either load or bleeding, the valve moves toward the closed position, motion continuing until desired pressure in the crossover is restored.

Crossover pressure acts against a spring-loaded diaphragm to operate a pilot valve, which in turn regulates a hydraulic cylinder and piston to actuate the crossover valve. Besides the diaphragm, the pilot-operating mechanism contains a loose-fitting piston, so arranged that if the diaphragm should break, a pressure difference would be established on the piston to control the pilot. The diaphragm's larger area and freedom from leakage provides a highly sensitive control, while the piston assures a valuable emergency control.

Extraction Control

Nozzle areas of the low-pressure turbine are such that under certain high-load conditions crossover pressure will exceed 10 psi g even with the extraction-control valve wide open. Under this condition, a combined pressure-reducing and non-return valve in the extraction line automatically acts to reduce the pressure therein to 10 psi g. This combination valve responds to heating-header pressure through action of a diaphragm and pilot device.

To operate the unit non-bleeding, a latching mechanism locks the pilot valve down so that the main valve is held open. Crossover pressure then varies with load, and throttling in the crossover is eliminated.

Changeover to high-pressure steam altered the division of load between high- and low-pressure sections. Electrical output for any given throttle-flow and bleed-steam quantity is greater than for the original unit, with increase in output mainly in the high-pressure section. For example, a maximum extraction of 15,000 lb per hr at 10 psi g, output of the new unit is 7000 bhp and throttle flow is 51,000 lb per hr, Fig. 5. For the same throttle flow and bleed-steam quantity the original unit would have developed only 5600 bhp. In other words, raising steam pressure and temperature has increased power output for these flow conditions by 1400 bhp, or 25%. The machine's maximum rating remains fixed by the unchanged dc generator.

Speed of the unit is controlled by a centrifugal governor with a speed regulation of 4%; that is, one in which a 4% speed change is needed for moving the control valves through the positions corresponding to the load range from zero to full load. A hand lever on the spring-loading device of the governor adjusts it over a speed range extending from about 95% to 105% of the rated speed.

Hydraulic Amplifier

The power cylinder which operates the steam admission valves is controlled from the speed governor through two stages of hydraulic power amplification. The centrifugal governor acts through a floating lever to operate a pilot valve controlling the primary power piston. The piston, in turn, acts through a bell crank upon a secondary floating lever to shift the pilot valve of the main power cylinder, admitting oil to move the piston which actuates the steam valves. Through the floating levers, a restoring action on the pilot valves follows each movement of the governor, resulting in a definite position of the steam-admission valves to suit load requirements.

To supply oil under pressure for operating the power cylinders of the governor transmission, a DeLaval-IMO pump, driven from the high-pressure turbine shaft, draws its supply from the turbine lubricating system. In view of the relative size of the power piston as compared with capacity of the governor oil pump, an oil accumulator consisting of a cylinder and

spring-loaded piston has capacity to satisfy fully any sudden movement of the power piston. The accumulator serves also as a pressure regulator, position of the piston controlling a valve through which surplus oil is returned to the overhead tank system.

Either of the overspeed governors, one on the high- and the other on the low-pressure turbine, will prevent overspeeding from any cause. These governors are set to act at 110% of the rated speed independently of the main speed-regulating governor. The overspeed governor of the high-pressure turbine consists of a weighted and spring-loaded plunger set radially in an extension of the turbine shaft.

Plunger Strikes Trigger

At a predetermined speed the plunger's centrifugal force overcomes the spring's counteracting force so that the plunger strikes a trigger, releasing the locking device of the throttle trip valve. A flyball governor on the low-pressure turbine shaft releases the latch of the tripping mechanism when the weights swing out to a predetermined position.

The throttle trip valve can be tripped closed by pushing a spring-loaded plunger in the outboard bearing cap of the high-pressure turbine or a handle on the low-pressure latch trigger. Excessive pressure in the crossover connection between high- and low-pressure turbines will close the throttle trip valve also, by operation of a relief valve on the crossover which, at a pressure of 30 psi g, admits steam to a sylphon to move a plunger against the tripping lever.

The emergency tripping mechanism can be tested without overspeeding the machine by pressing an emergency governor trip test plunger. Pressing the plunger spurts a jet of oil from the lubricating system against the plunger of the high-pressure overspeed gov-

(*Continued on page* 138)

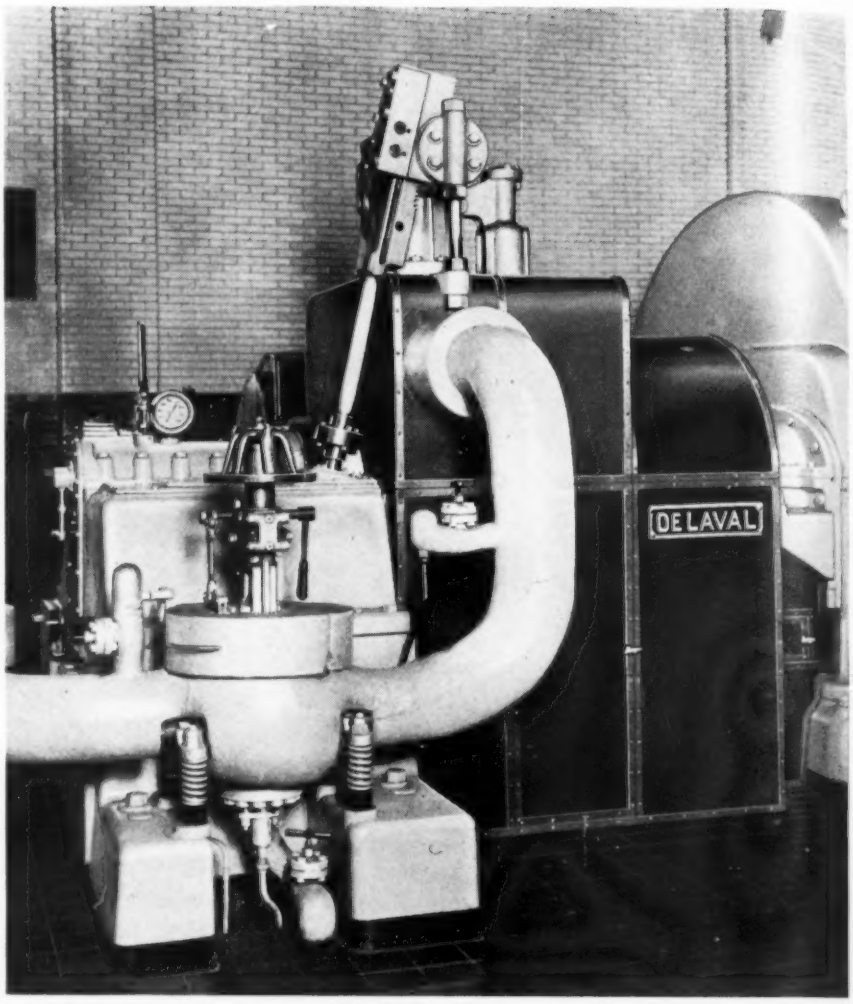


Fig. 3—High-pressure side of rebuilt turbine, showing throttle trip valve and mechanism for operating the steam admission valves from the secondary power cylinder

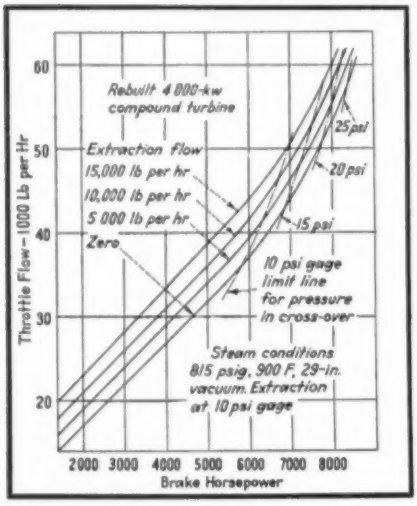


Fig. 5—Diagram showing range of loads at which various amounts of steam at various pressures can be extracted from the cross-over of modernized turbine

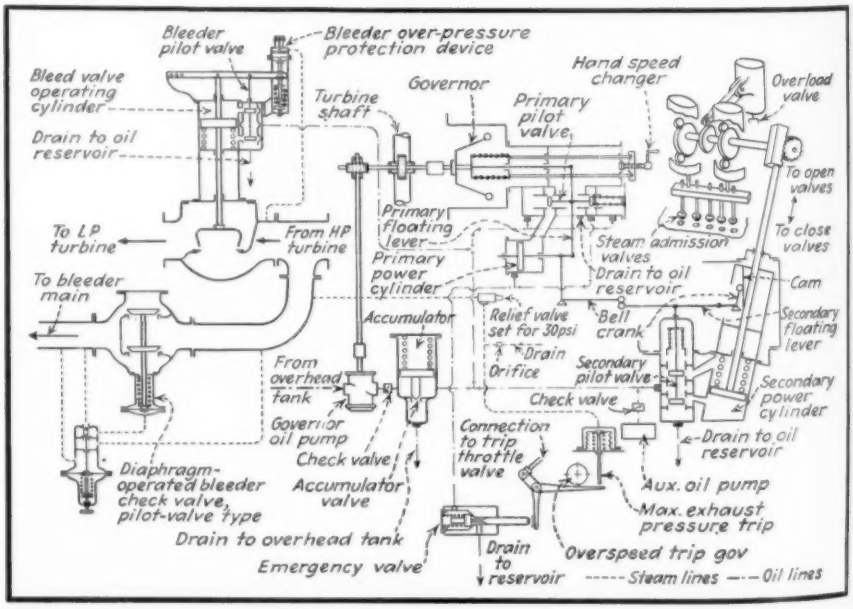


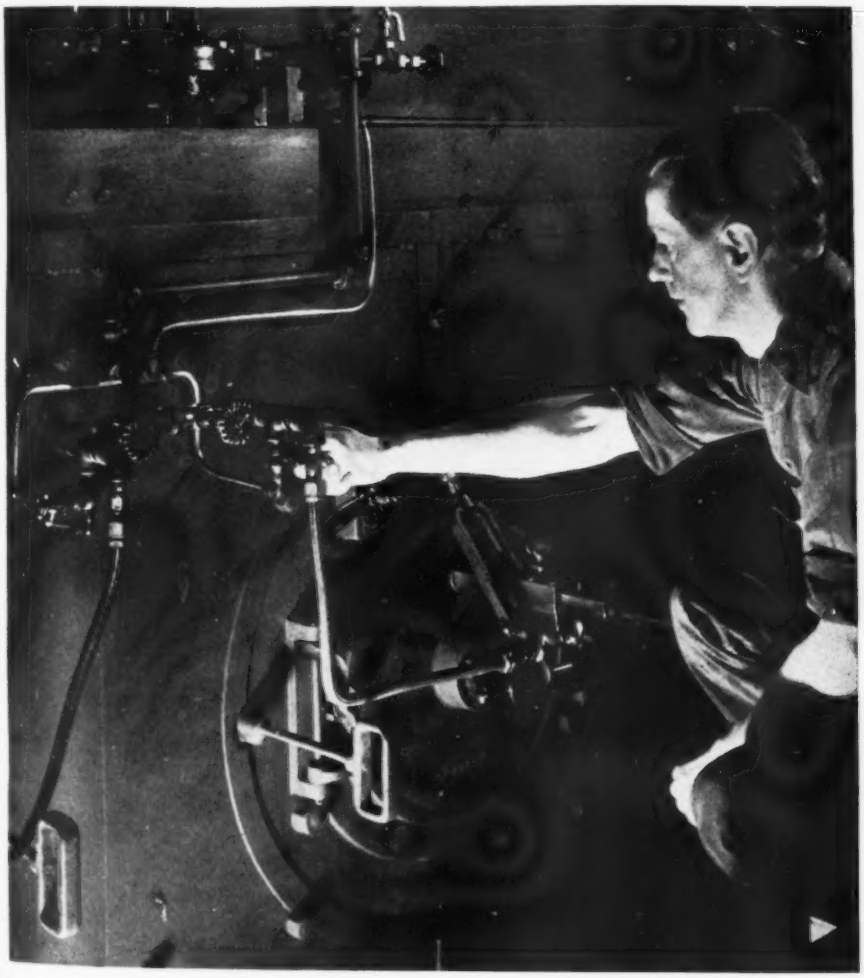
Fig. 4—Schematic diagram of governor and bleeder controls of rebuilt unit

Good Operation Key to Small-Boiler Maintenance

The "know-how" of small-boiler maintenance is part of L W Hayward's job as engineer in Babcock & Wilcox Co's service department. Here are his suggestions for better operation and successful maintenance

▶ THE SECRET OF SUCCESSFUL boiler maintenance lies in thinking and acting on the principle that operation and maintenance always go together. It is only by making sure that boiler units operate properly that you can keep maintenance under control. Good operation is the best preventive maintenance; it means elimination of unexpected and costly breakdowns between regular outage periods, lower maintenance costs and higher average boiler efficiency.

Smooth operation and maintenance depend on operating-force teamwork. Regular staff get-togethers give a broad understanding of what is to be accomplished and put operators on the alert. Placing a list of items needing care and study before such a group stimulates thought on specific boiler-plant problems, leads to ideas and suggestions, and thus aids in better control of operating and maintenance matters. Problems differ from plant to plant but the basic questions and answers that follow will serve as a starter in a comprehensive, detailed attack on today's important boiler-maintenance job.



Recent experience shows slag can be a problem on oil- as well as coal-fired units

Do slag and ash accumulate on boiler tubes and furnace walls, in ducts and breechings? This still forms a major operation-maintenance problem because of the varying characteristics of fuels, particularly variations in ash properties and fusion temperatures. Unimportant for natural gas and coke-oven gas, slag and ash accumulation becomes a real problem in the burning of coals, blast-furnace gas, refuse products and, recently, of oil fuels. It is easily handled on most units as long as good grades of fuel are used but becomes more difficult when fuel quality varies.

Conventionally designed soot-blower units handle removal of dry ash and dust satisfactorily and, with properly installed equipment, maintenance is not high. Needed are periodic checks to maintain proper alignment of jets with tubes; careful watch of elements for growth or shrinkage; proper drainage of soot-blower lines to prevent water reaching hot elements; and maintenance of moving parts.

Slag Forms at High Rating

But the problem becomes more difficult on boilers operated at high rates of heat input per sq ft of heating surface when dry fused ash and slag in a plastic state often have to be removed from furnace walls and first-pass boiler tubes. With certain types of oils, fired at high rates of heat input, a hard build-up of extremely tenacious slag has to be handled. This condition calls for special slag blowers operating in zones of high temperature with high steam pressure. Maintenance of this type of equipment is usually more difficult. Often hand lancing must supplement the mechanical slag-blowing equipment in zones that the latter cannot reach from its fixed position.

When units operate at high rates of heat input and use fuels that build up considerable quantities of slag, the furnace walls and front boiler bank need careful attention. These surfaces should not be allowed to become completely

covered with slag because the gas temperature to the superheater gradually increases, resulting in excessive superheat temperature, along with the difficult job of keeping surfaces clean.

Removing slag at regular intervals from furnace walls and front-row boiler tubes with mechanical slag blowers or hand lancing keeps a large percentage of the furnace "black"; eliminates the problem of elevated temperature to the superheater; and greatly reduces the over-all cleaning problem. Often these surfaces will shed because of a change in load resulting from a change in furnace temperature. When this does not happen a little help from a hand lance using air; water and air; or water alone in small quantities, properly directed, will greatly reduce the over-all unit cleaning problem. Many companies make the cleaning of furnace walls a means of maintaining the desired constant superheat temperature.

High maintenance of superheaters? This can be a large item and when it exists, it usually comes from any of four causes:

1. Carryover of solids from the boiler water by wet steam with resulting overheating and failure of superheater tubes.

2. Slag-plugging of superheater gas passages causing high concentrated heat inputs over localized sections of the superheater, with resulting failure of supports, overheating and failure of tubes.

3. Bringing boilers on the line too rapidly, resulting in overheating of superheater tube metal before steam passes through the tubes to keep them cool.

4. Improper laying up of superheater when boilers are out of service.

Carryover of boiler-water deposits with the steam should not occur, but if it does, check these possibilities: (1) abnormally high water-level in steam drum, (2) high boiler-water concentrations, (3) presence of oil and organic material in boiler water, resulting in foaming or priming, or (4) loads being carried above expected boiler capacity.

It's important to know the limits of water level, load and boiler-water concentrations that can be carried without carryover, and these limits are easily determined by using a calorimeter for pressures up to 500 psi and electrical steam-conductivity equipment for higher pressures.

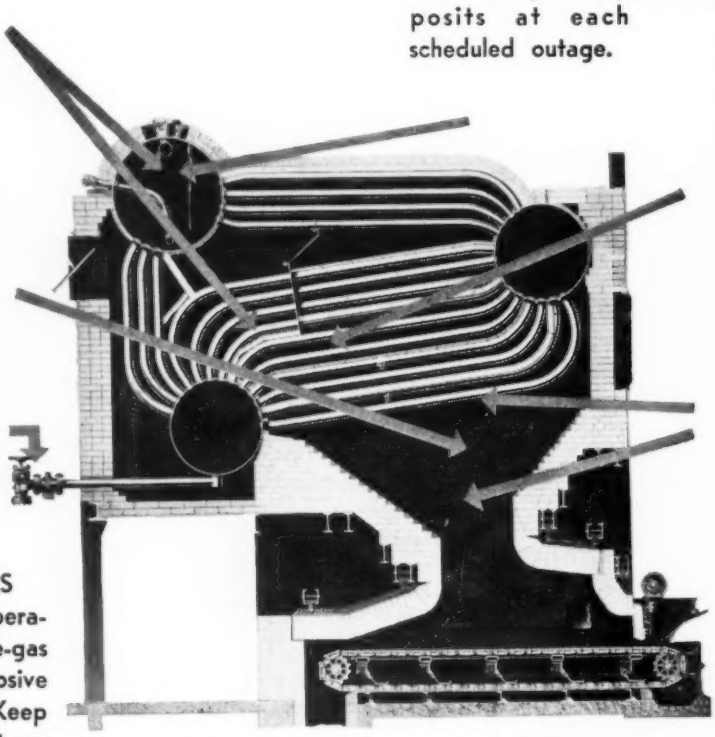
These values determined, set up and adhere to definite operating limits that should eliminate carryover troubles. Even though operators follow these limits, inspect superheater tubes for internal deposits at each scheduled outage. Wash out any deposits by flushing the superheater with hot feedwater to dissolve solids. If this method does not

BOILER MAINTENANCE CHECK CHART

Watch feedwater treatment to be sure no scale forms in tubes, no oxygen corrosion occurs in tubes or drums

Find limits of water level, load and concentration that can be carried without carryover and adhere to them. Inspect superheater tubes for internal deposits at each scheduled outage.

Check setting for air leakage, which is a source of slagging trouble, high stoker maintenance, burner difficulties, superheat troubles and low efficiency



Check soot blowers periodically to maintain proper jet-and-tube alignment; watch for growth or shrinkage; drain soot-blower lines to prevent water reaching hot elements; maintain moving parts

Blow down regularly to keep sludge concentration at proper minimum

Keep furnace walls and first-pass tubes free from slag likely to form when burning poor fuel at high rating. Supplement mechanical blowing with lancing

ECONOMIZERS

If tube-metal temperature falls below flue-gas dewpoint corrosive deposits form. Keep feed temperature above 212 F (minimum for low-sulphur fuels). Remove deposits, by soot blowing or lancing, as fast as they form

SUPERHEATERS

Slag-plugging causes local overheating and tube failures. Maintain soot blowers and use hand lancing if needed. Make sure steam flows in tubes before hot gas passes through superheater

AIR HEATERS

Reduce "cold spots" by baffling to distribute gas and air more uniformly. If high sulphur-and-moisture fuels are burned, bypass some cold air around heater or circulate hot air through heater during low-load periods

dissolve them, resort to acid cleaning. If carryover persists, examine steam-drum baffles carefully for tightness. If necessary, call in the boiler manufacturer to locate the trouble.

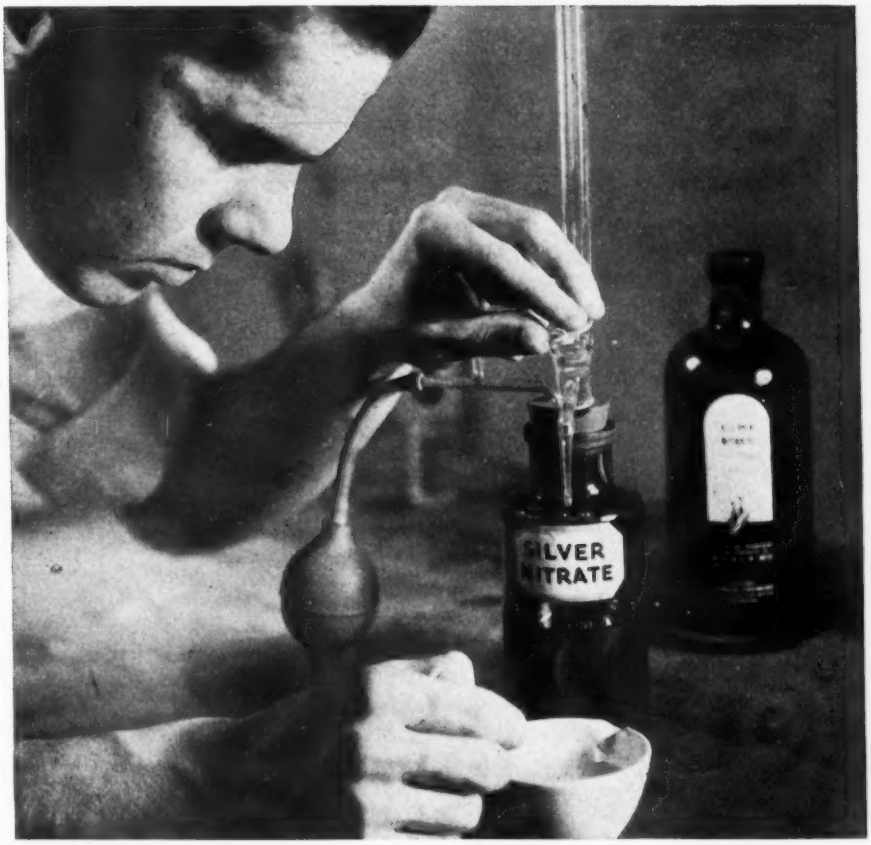
Proper maintenance of soot-blower equipment usually prevents closing of superheater gas passages with slag. If it is not sufficient, try some hand lancing through properly placed doors. Little handwork should be necessary, however, if furnace walls and front boiler bank are cleaned as already outlined.

Many superheaters are damaged by bringing the boiler on the line too rapidly from cold or from a banked condition. Damage can result if hot gas (over 950 F) passes over the superheater tubes before steam flows through the tubes to keep the metal cool. On non-drainable superheaters it is necessary to evaporate the water out of all individual elements before allowing high-temperature gas to enter superheater tubes. This is necessary because cooling steam cannot flow through elements trapped with water. It can be evaporated by keeping gas entering the superheater under 950 F until steam flows through all elements. Time rate to bring a boiler on the line and maintain safe superheater tube temperature can be determined by installing thermocouples on a number of individual superheater elements, and a gas couple for measuring gas temperature to the superheater. After the time to put a boiler on the line safely is once established, future firing schedules should be set up accordingly.

Open Superheater Drains

Superheaters are often damaged by failure to open header drains on idle boilers, thus allowing condensate, which is low in pH, to stand in the headers and around tube ends. This condensate, in the presence of oxygen, often corrodes the rolled tube ends. This can also happen if leaking non-return valves allow steam to condense in the superheater headers.

Scale in boiler tubes? It should not be found there. Today's boiler units are built for high rates of heat input and cannot be expected to operate with this handicap. Loss of tubes because of scale or oil is the exception when feedwater is treated by competent personnel. Neither should oxygen corrosion develop in drums and tubes, with the proper deaeration of feedwater now universally used and, perhaps, with the feeding of small quantities of sodium sulphite to the boiler to remove final oxygen traces. Pay careful attention to the amount of sludge that is carried in the circulation system, as it settles out in drums and headers, or sticks to inside surfaces of tubes. With sludge of certain characteristics and of sufficient quantity, tube overheating may come from restriction of water flow to heating surfaces and from insulation of tube insides which prevents free heat transfer from water to tube metal. When treatment of large quantities of makeup feedwater is necessary, competent personnel should, of course, control elimination of large quantities of sludge from boiler water.



Oil or scale rarely causes tube loss when feed treatment is properly controlled

When waterwall tube failures occur it is becoming common practice, with permission of the State or the insurance company concerned, to weld in a new section. This type of repair on furnace-wall tubes reduces not only the large number of "spares" of many shapes carried in stock, but also outage time, which is considerably less if properly qualified welders weld sections into tubes that are difficult to replace.

Maintenance of economizers and air heaters? This is a small item except on units which operate at extremely low gas-outlet temperature and with low economizer inlet-water temperature. On these units painstaking care will prevent closing of gas passages and corrosion of metal parts. In connection with the latter, note these pointers:

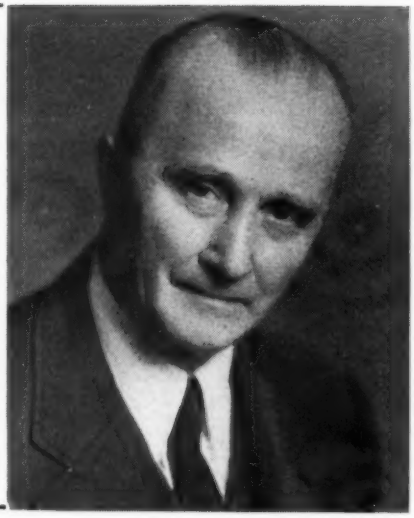
External deposits on economizer and air-heater tubes are related closely to actual tube-metal temperature. If it falls below the dewpoint of the flue gas, corrosive deposits will form. Dewpoint, a function of gas temperature, varies with the percentage of sulphur and moisture in the fuel burned; the higher the sulphur and moisture, the lower the dewpoint and the greater the trouble with deposits. At times these deposits are highly corrosive and will eat away external tube surfaces if metal temperature is not raised.

Metal temperature of economizer tubes can be raised by increasing feedwater temperature. In general, it should not go below 212 F, which results in minimum metal temperature for low-sulphur fuels (in the order of 1%). Temperature should be raised as sulphur in fuel increases. Equipment manufacturers can give useful information on limits of metal temperature for fuels having varying sulphur and moisture quantities. Little can be done to reduce external corrosion on economizers by increasing flue-gas temperature as the water in economizer tubes largely determines metal temperature. If the cost of increasing feedwater temperature cannot be justified, some relief will result from installing heavier gage

(*Continued on page* 142)

SHORT WORDS

C M Ripley has a ready faculty for analyzing our reactions to words. This graphic quality of mind, combined with engineering training, years of service in the publicity department of General Electric Company, wide reading and travel, makes his suggestions in this article of outstanding value and interest. Mr Ripley has written two books, "Life in a Large Manufacturing Plant" and "Romance of a Great Factory." His talks include "Power for War," "Little Known Facts about Electricity" and "The Kilowatt-hour."



▶ SHORT WORDS are a strong ally in making your ideas crystal clear. They help you talk and write so that even strangers know instantly just what you mean and all you mean. Even in difficult situations you are not likely to be misunderstood or half understood, and people remember better what you say.

Here's how Charlie McCarthy brought order out of chaos: When an applicant for a job as cook said, "I am a famous chef and caterer—a past master of the culinary art," Charlie asked, "But can you cook?"

Another funny burlesque, this time on Latin terms for common ailments, was broadcast some time back. Fibber McGee had a black eye—and a big one. He and Molly were in the doctor's office:

Doctor: "Hold still, McGee!! . . . Hmmmm . . . yes, yes, yes . . . the capillary engorgement seems to have involved quite an area of epidermic infusion, but the iris, cornea and vital veinous structures appear to be affected in only a minor degree by either impact or abrasion—a pretty severe contusion."

Molly: "Yes—and it's badly *bruised*, too!"

Legal Jargon

Here's an example that pokes fun at legal jargon. A man had been hurt in a railroad wreck. Lying in his bed, he told his story to a lawyer:

The Man: "Say—yuh kin git me a big wad o' dough outa de comp'ny, can't yuh?"

The Lawyer: "In my opinion, a complaint sounding in tort may be drawn, based upon the doctrine of res ipsa loquitur. A prima facie case can thus be alleged and, if the defendant fails to rebut the presumption of negligence so raised by the allegations, your evidence should be sufficient to sustain a verdict." All the lawyer meant was that his client had a good chance to win because the company must prove the wreck was not its fault.

Engineers can be as bad as the worst of them. For instance: "The resistance and reactance inherent in the design of this motor are of such an order of magnitude as to prevent a flow of current sufficient to bring it up to full speed, in spite of the fact that the motor is equipped with an amortisseur winding." Why not say that the motor is too small for the job?

Economist at Work

Now see what happens when technical verbiage is applied to the field of business and economics: "The significance of this widespread problem can be grasped when it is recognized that the phenomenal growth of cities which has taken place during the past several decades is attributable to our efforts, in this industrial era, to achieve convenient physical accessibility between the many interdependent parts of our intricate economic and social mechanism." What the author says is that our cities have grown because of good transit systems.

Wasn't it Samuel Johnson who said that language was invented to conceal thought? And in the Gay Nineties didn't Americans relish fun at the expense of overcultured Boston? There, the citizens never yelled "fire" but were supposed to exclaim, "Conflagration, conflagration, hasten hither with the apparatus for extinguishing combustion."

Hugh Chalmers, sales manager, taught his men that, "Whatever we need, we must pay for whether we buy it or not." Good philosophy, plainly told in short words. And more recently, "It takes less time to do a thing right than to explain why you did it wrong."

Here are some simply phrased thoughts that have gone the rounds in business circles:

"Do what no one else does."

"More goods for more people at less cost."

"The more electricity you use, the cheaper it gets."

"It costs less to live better."

Here follows a big share of the farm electrification story in 86 words: "At the five-cent rate, you can pump the water for the farm and the house for five cents a day; milk a cow twice daily for eight cents a month; wash the clothes for ten cents a month; make the ice for the house for five cents a day; saw a cord of wood for five cents; hoist seven tons of hay for five cents; light the house and farm for five cents a day; and churn 100 lb of butter for five cents." All these words are monosyllables (single syllables), except water, daily, seven, hundred and butter—terms that all can understand.

We might learn something from the methods used by the great writers of the past, for their ideas, clearly expressed in simple words, have survived through the centuries. Isn't it possible that their method was one of the big secrets of their power—and their charm? Shakespeare wrote, "An honest talé speeds best being plainly told." —Richard III.

Big Thoughts, Small Words

The Bible contains thousands of short words: "Rise up, my love, my fair one, and come away. For lo, the winter is past, the rain is over, and gone."—Song of Solomon.

So in more modern times, Philosopher Ben Franklin, Poet Rudyard Kipling and Editor Arthur Brisbane all strove for the utmost simplicity. They chose short words. I believe that little trick was in no small degree the secret of their punch and style. So far as I know they never bragged about it.

Ben Franklin wrote in "Poor Richard," "Dost thou love life? Then do not squander time, for that is the stuff life is made of." All those words except "squander" have only one syllable. And again in "Poor Richard" he wrote, "For the want of a nail the shoe was lost; for the want of a shoe the horse was lost; for the want of a horse the rider was lost." all monos but "rider."

CARRY A PUNCH

Long words are the bunk, says Ripley.

Shakespeare and Kipling agree. Here's one secret of good writing and good talking for every big or little engineer who'd like to go places.

In Kipling's poem "If" 97% of all words have two syllables or less and 87% are even monos. Perhaps that's why so many people can quote Kipling from memory. Short words stick.

Steinmetz called Kipling the poet of the engineer. He loved to quote this part of "M'Andrew's Hymn":

". . . the auld Fleet Engineer
That started as a boiler-whelp—when steam and he were low.
I mind the time we used to serve a broken pipe wi' tow!
Ten pound was all the pressure then—
Eh! Eh!—a man wad drive;

Believe-It-or-Not Ripley vouches for this miraculous formula a French physician used to cure thousands. He made the most of the fact that Latin terms for common ailments and unreadable prescriptions defy the understanding of most of us

An' here, our workin' gauges give one hunder sixty-five!
We're creepin' on wi' each new rig—less weight an' larger power:
There'll be the loco boiler next an' thirty miles an hour!
Thirty an' more. What I ha' seen since ocean steam began
Leaves me no doot for the machine: but what about the man?"

Out of these 98 words, one has 3 syllables, 18 have 2 syllables, and 79 have only one syllable.

Mother Goose and other rhymes in nursery days blazed the trail and paved the road from the eye to the brain, and from the ear to the brain, for the easy and rapid passage of short words like hot, cold, cook, fast, quick, whip, dog, cat, ice. It's easy to remember "Jack Spratt Could Eat No Fat"—it's 92% monos; "Tom, Tom, the Piper's Son" is 89%; "Mary Had a Little Lamb," 85%; and "Old King Cole" 82%. The first four verses of "The House That Jack Built" contain 99% monos, and the first 69 words are all monos.

Now you might say that all the above quotations were selected just to prove a point, but that they don't prove anything; that all they do is show that sometimes some people wrote some things in short words.

But before I was born a book lover named Bartlett selected the most famous passages in the literature of all ages and all languages. The 1500-page book is called Bartlett's "Familiar Quotations" and every library has a copy—the index alone takes over 400 pages. From all the English literature that was written in the 300 years before Shakespeare, Bartlett chose only 363 quotations. That averages about one a year.

These quotations contain 4030 words, or an average of only eleven words each. Think of it—Bartlett felt that from the writings of the English during three centuries only eleven words a year deserved to live!

And of these 4030 words, 3025 have only one syllable—that's 75%.

To sum up, all the sentences, or quotations, average only eleven words each; and over three-quarters of these words have but one syllable. Of such are the gems of literature that have lived now 300 to 600 years. They are from Chaucer, Heywood, Sir Walter Raleigh, Edmund Spencer, Christopher Marlowe.

Perhaps if we used more short sentences and short words our writings might be remembered—and quoted.

"And, departing leave behind us
Footprints on the sands of time."

Don't forget that an inch of space or two minutes of time hold more words when the words are short. Of course we must also see that they hold more ideas as well: "Give me liberty or give me death." "Fifty-four forty or fight!" Both masterpieces as to substance, brevity and power. And easy to remember.

Finally, from a book on how to write, keep in mind this outstanding paragraph, quoted from memory: "At any given moment your readers, or your hearers, have just so much mental energy. If they must spend that energy trying to understand what you are saying, there will be no energy to digest what you have said."

For a free reprint of this article (one copy each while they last), send stamped, addressed envelope to Editor, POWER, 330 W 42nd St, New York.

TO SUM UP, REMEMBER:

1. Short words and sentences add punch and clearness. 2. People know exactly what you mean. 3. You are not likely to be misunderstood, or half understood. 4. Everyone remembers what you say or write.

Maximum Aid in the War Effort

Theme of A I E E Convention

Electrical power-equipment manufacturers and plant operators get together to discuss emergency measures for increasing the output of existing power equipment, emergency maintenance practices, manpower problems, and rebuilding and rehabilitating power equipment

▶ WITH MAXIMUM AID in the war effort as its principal objective, the American Institute of Electrical Engineers held one of its most successful conventions, from January 25 to 29, at the Engineering Societies Building, New York City. More than three-quarters of all papers, reports and conferences were devoted to making better use of available electrical equipment, manpower and critical materials to assist the war effort.

To make available all possible information on a given problem, based on wartime experience, many meetings took the form of conferences. Single sessions were held on each of the following: power-generating equipment; industrial-power distribution; analysis of military loads and postwar applications; getting the most out of electronic tubes in wartime; emergency rating of power cables; loading power and transmission systems; selection of motors and controllers; defense lighting; relays; technical manpower in the war effort; and war-emergency education.

A conference sponsored by the Power Generation Committee, with A C Monteith, Westinghouse Co, as chairman, had for its objective correlation of all possible ideas on how to get the most out of present power-generating plants and equipment.

Last year at a meeting of the committee, two subcommittees were formed. One studied and reported the electrical manufacturers' recommendations for emergency loading of power-generating equipment; the other correlated information on what power companies are doing to get the most out of existing equipment. Both reports were presented and, although in preliminary form, they contain a wealth of material on emergency measures to increase output of power-generating equipment.

On large long-core generators, the expansion and contraction of the coils of a machine, rather than an increase in temperature, may be the limiting factor in the amount of overload that a generator can carry, particularly if shut down part of each day

Makers' Recommendations

The manufacturers' subcommittee, with C M Laffoon, Westinghouse Co, as chairman, and S H Mortensen, Allis-Chalmers Co, and Robert Treat, General Electric Co, as members, considers in its report: generators which operate below specification temperature guarantees; increase in generator output by changing generator voltage; generators with class B insulation and class A temperature guarantee; existing generators with class A insulation; operation of generators at increased output for

In most cases, the output of hydrogen-cooled generators can be increased approximately 15% by increasing the average pressure of the cooling gas in the machine from 0.05 to 15 psi gage

short periods; expansion and contraction of armature windings; expansion and contraction of field windings; operation of hydrogen-cooled generators at increased gas pressure; excitation requirements; effects of increased generator loading on system stability; rearrangement of systems; limiting fault durations; and improved control of generator excitation.

Long-Core Generators

On large long-core generators, expansion and contraction of coils, rather than an increase in temperature, may be the limiting factor in the amount of overload a machine can carry safely. Coil expansion and contraction becomes particularly serious if a machine operates under heavy loads part of the day and, after that, is shut down. Under such conditions, the coils expand and contract, causing a movement of the conductors inside the coil insulation and of the insulation in the core slots. If the machine operates for long periods without a shutdown, movement of the coils, which affects insulation life, may have less effect on it than high operating temperatures.

After giving consideration to the most important factors involved in emergency loading of power-generating equipment, the manufacturers' subcommittee made the following conclusions and recommendations:

1. Some additional output can be obtained by taking advantage of the temperature margin that may exist in specific units. This may necessitate small changes in generated voltage and operation of each unit at the power factor most favorable for increased generator output.

2. Generators with class B insulation and class A temperature guarantees for both rotor and stator can be operated continuously at ratings (approximately 115%) which result in recognized class B temperatures. Life expectancy of the windings will be decreased to that corresponding to the higher temperature.

3. Increased generator output, at temperatures in excess of the limits recognized for the class of insulation and its application, results in an appreciable decrease in life-expectancy of the windings. This method of obtaining additional output for continuous or short-time loadings, with its resultant decrease in insulation life-expectancy, may be justified economically under specific conditions.

4. Increased output can be and, in some cases, is obtained by taking advantage of low ambient temperatures of the cooling medium. Although specification values of total temperatures are not exceeded, life-expectancy is decreased because of increased differential expansion and contraction of the winding copper with respect to the surrounding iron.

5. In most cases, output of hydrogen-cooled generators can be increased approximately 15% by increasing average pressures of the cooling gas from 0.5 to 15 psi gage. Such increase in gas pressures may require changes in auxiliary equipment for supplying oil to shaft-gland seals and for operation of the gas control.

6. Because so many factors are involved in determining the available increase in output of large power-generating equipment, and because any increase in loading must be carefully checked in relation to other associated main equipment, auxiliary apparatus, and the distribution system with its connected load, it is recommended that each case be checked with the respective generator manufacturer. After obtaining and reviewing all essential data, user and manufacturer should mutually agree on rating capabilities of each particular unit, with full realization that increase in output will result in shorter life-expectancy and affect other important characteristics of the unit.

7. It is recommended that the user follow the manufacturer's procedure for starting up and shutting down, and normal operation of a particular unit for which an increase in output is mutually agreed on, in order to reduce mechanical deterioration of insulation caused by differential expansion and contraction effects.

Rebuilding, Rehabilitation

For the plant operators' subcommittee, R P Crippen, Ebasco Services, Inc, was chairman, and H A Dryar, Philadelphia Electric Co; A J Krupy, Commonwealth Edison Co; G H McDaniel,

American Gas and Electric Service Corp; and M J Steinberg, Consolidated Edison Co of New York, were members. To obtain a pooling of ideas for its report, the subcommittee sent a questionnaire to a group of power companies. From the replies, came a 56-page report, compiled under the headings: maintenance; load limits on equipment; power-factor correction; interconnected operation; effects of voltage and frequency on system loading; personnel problems; rebuilding and rehabilitation; miscellaneous; maintenance and repair methods.

Rebuilding and Rehabilitation

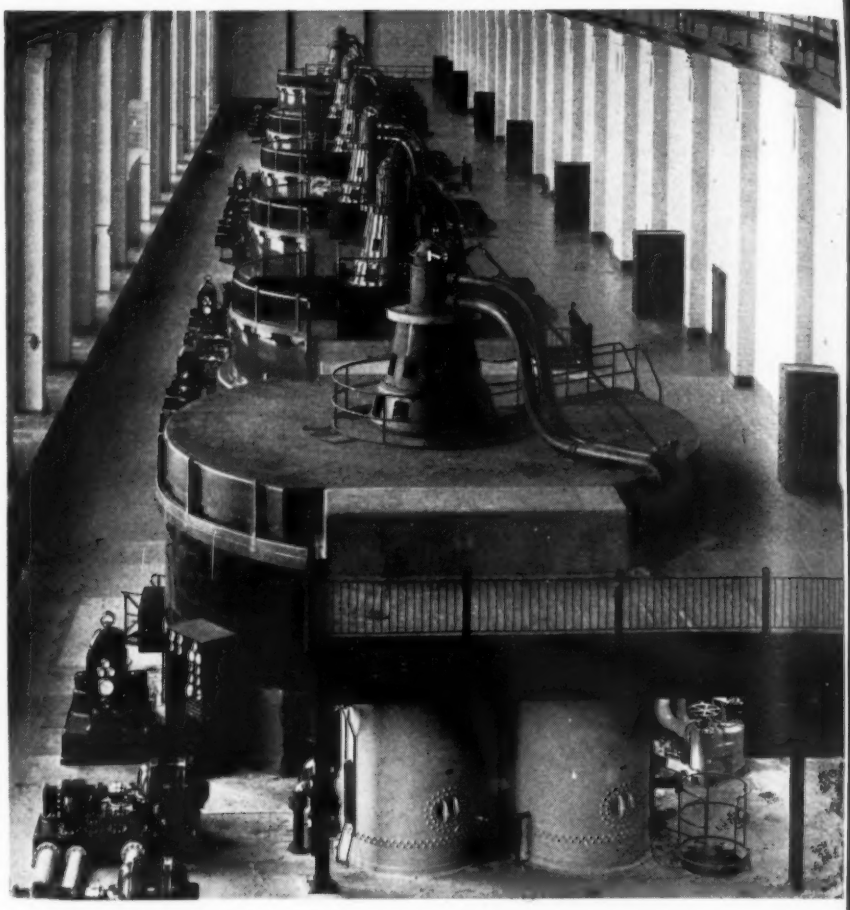
The sections on rebuilding, rehabilitation, maintenance and repairs are a summation of what the power companies have done, or are planning to do to meet demands for more and more power. These sections are here given as presented in the report. In them, every plant operator should find helpful suggestions for getting more capacity out of his equipment and improving its reliability.

Rebuilding and modernizing old stations and equipment usually means bringing back into service equipment that has been shut down for some time, or reconditioning old equipment to remove weaknesses and limitations.

A program for increased output within a station is usually based on a survey which locates existing bottlenecks and shows how to gain a little here and there by careful review of many small details. All ingenuity and inventiveness should be brought to bear in removing bottlenecks that limit over-all capacity of station or system.

Rebuilding equipment for increased output involves modernization of old equipment; replacement of parts of existing equipment; better adaptation of equipment to a particular use; and ingenuity in increasing capacity with minimum use of critical materials, at minimum cost. Addition of fans, blowers, cooling fins or other devices often means additional capacity.

Auxiliary cooling by means of fans, or blowers, is being used extensively on transformers, particularly to overcome summer temperature conditions; an increase in capacity of 25% is often obtained. Circulation of oil through auxiliary oil coolers may increase transformer capacity as much as 50%. Water spray has received attention for cooling transformers, including, in one case, fire-protection sprays already installed. Sometimes, principally in emergencies, auxiliary cooling increases transformer output enough to give spare capacity during outage of another bank.



Waterwheel generators are so constructed that the field coils are comparatively free to move with a change in temperature similar to that of the armature windings. Therefore, expansion and contraction of the conductors is not the really serious problem that it may be in the operation of large high-speed turbine-generators

It is not usually economical to reinsulate generator windings and motors until definite insulation deterioration is indicated or failure occurs. However, when reinsulation becomes necessary, a better grade of insulation may give greater capacity or longer life.

When class A insulation is replaced by class B in motors or generators, winding capacity can sometimes be increased because the operating temperature permitted has been increased, and because new insulation may require less space and, therefore, permit a larger copper cross-section in the same slots. In some cases, such class B insulation is a combination of mica and Fiberglas.

Current-Carrying Parts

Answers to the questionnaire indicate an extensive and satisfactory use of silverplating both to increase capacity and to reduce maintenance of current-carrying contact parts. In some cases, burned switch contacts are rebuilt by welding and then silverplated.

Here are examples of specific steps that have rehabilitated equipment or increased its output capability:

1. One plant has put old boilers in workable condition; cut delta lines over to "Y"; mounted idle transformers on insulators and cut in transmission lines to give a fixed boost; taken down and used ground conductors as power conductors in new line extensions, etc.

2. In several stations 25-cycle units have been rebuilt for 60-cycle service with a gain in capacity and operating efficiency. Two 12,500-kw units are being moved from one station, currently held as "cold reserve," to another that can better utilize this capacity.

3. Installation of a topping boiler and turbine was in progress but was canceled at the suggestion of WPB and a new condensing unit substituted at another location to obtain greater generating capacity from the same boiler capacity.

4. Height of a stack had been reduced by approximately 200 ft by a severe earthquake in 1933. Installation of induced-draft fans compensated for this reduced height, and brought plant output up to its previous capacity.

5. Rehabilitation of atmospheric cooling towers at a steam plant and re-

arrangement of water circulation therein, about three years ago, resulted in increased output capacity of approximately 5000 kw.

6. Needle nozzles of certain hydroelectric units in a hydro plant have been redesigned with resultant increase in output from 1% to 2%.

7. Several years ago a high-head hydro plant was rebuilt and rerated from 14,000 kw, 0.9 pf to 20,000 kw, 0.8 pf for peak-load and spinning-reserve operation. New fields were installed in generators to permit operation at rated kva and zero power factor. Project is very satisfactory.

8. Two transformer banks at a major step-down substation have been rewound and rerated from 22,500 kva to 30,000 kva.

More Plant Capacity

9. A job in progress on a steam turbine-generator will result in rerating unit from 20,000 kw to 30,000 kw. Transformers, fields and stators are being rewound, and steam blading replaced. Switchgear, steam piping and surface condenser are adequate for the higher machine rating.

10. Material has been ordered for rebuilding an obsolete steam turbine of 4000-kw capacity, but work is not yet in progress.

11. Stokers have been installed in an old hand-fired plant to improve operation and increase capacity.

12. Quite often, as a system is expanded, much equipment becomes basically useless, particularly oil circuit breakers, potential and current transformers, and associated equipment. In one substation, better service and improved relaying were obtained by removing two of four 66-kv oil circuit breakers. Useless sectionalizing of transmission lines by oil circuit breakers is avoided.

13. One station, inoperative since 1929, has been put back into active standby by overhauling turbines; inspecting station piping; repairing or replacing pipe, fittings and bolting, where necessary; overhauling station auxiliaries; inspecting and retubing boilers, and renippling when necessary; revamping furnaces when improved capacity appeared practicable; repairing others; repairing breechings or uptakes to the stack.

14. Equipment has been rebuilt for increased output by installing copper shunts in circuit-breaker bushings; replacing contact fingers on disconnects; silverplating contact surfaces; replacing connectors on copper leads; and installing radiators on copper leads connected to bushings, disconnects and current transformers.

15. Baffles in 18 boilers have been changed to reduce draft and improve steaming performance.

16. Output of equipment has been increased by an improvement in the cooling of generators. Output of hydro turbines has been increased either by changing runners or by modifying existing ones. Modification consisted of smoothing surfaces of runner buckets by grinding or, in some cases, cutting off a strip from trailing side of the buckets. Capacity has also been increased by raising headrace levels and excavating in tailraces to increase draft head of the turbines.

17. Transformers have been rebuilt from water cooled to air cooled, installing sufficient radiators to obtain increased capacity. Portable blowers provide increased capacity while waiting for delivery of permanent blower cooling equipment.

18. Rebuilding all oil circuit breakers in one plant increased rupturing capacity and eliminated fire hazard.

19. Auxiliary cooling means, in the form of induced-draft cooling tower, is being considered for increasing effectiveness of an existing generator air cooler.

20. Small individual fans, as recommended by manufacturer, have been used for transformers. Water spray on transformers, utilizing existing facilities installed for fire protection, has been discussed but has not yet been necessary to meet load requirements.

Fans in Cooling Systems

21. Auxiliary cooling has been put on certain transformers. For example, on two banks of transformers, each of 30,000-kva capacity, indoor, water-cooled, arrangements were made to install air coolers outdoors and circulate oil from these transformer banks through the air coolers. An increase of 25% in bank capacity was thus obtained by this change.

22. To increase capacity, a closed-circulation cooling system was put on a generator which formerly exhausted into the turbine room.

23. Ventilating system has been installed on a 13.2-kv bus structure, as bus copper, connections and disconnects were overloaded. Fans, installed to force and circulate air in bus tunnels and disconnect compartments, are effective and inexpensive. Buses now operate 50 to 60% above load they were designed to carry.

24. Cost of additional transformers, to increase capacity of a 60,000-kva, 66-kv substation by 50% was estimated at $115,000. Installation of three 5000-cfm fans per single-phase transformer (18 fans for 2 banks) at cost of $10,000, carries necessary peak loads in warmest weather, thus saving critical material and expense.

25. Five other companies report installation of fans or blowers to increase transformer capacity.

26. In a transmission station, under certain conditions, recirculation of transformer cooling water must be reduced and city water used in order to carry station load. This occurs only for

(*Continued on page* 144)

TIPS ON MAINTENANCE AND REPAIR

The following six methods that reporting plants have worked out successfully may prove useful to others under war-emergency conditions:

1. Contact parts of switches are built up by welding with silphos and phos-copper. They are then smoothed off and silverplated.

2. Babbitt bearings are being built up by metal spraying instead of by melting and repouring. Time is saved.

3. Insulation is removed from old soft-drawn copper wire; it is cut to proper length and used for tie-wires.

4. Intricate equipment parts are made by hand from scrap-pile parts when they cannot be bought or delivery is unsatisfactory.

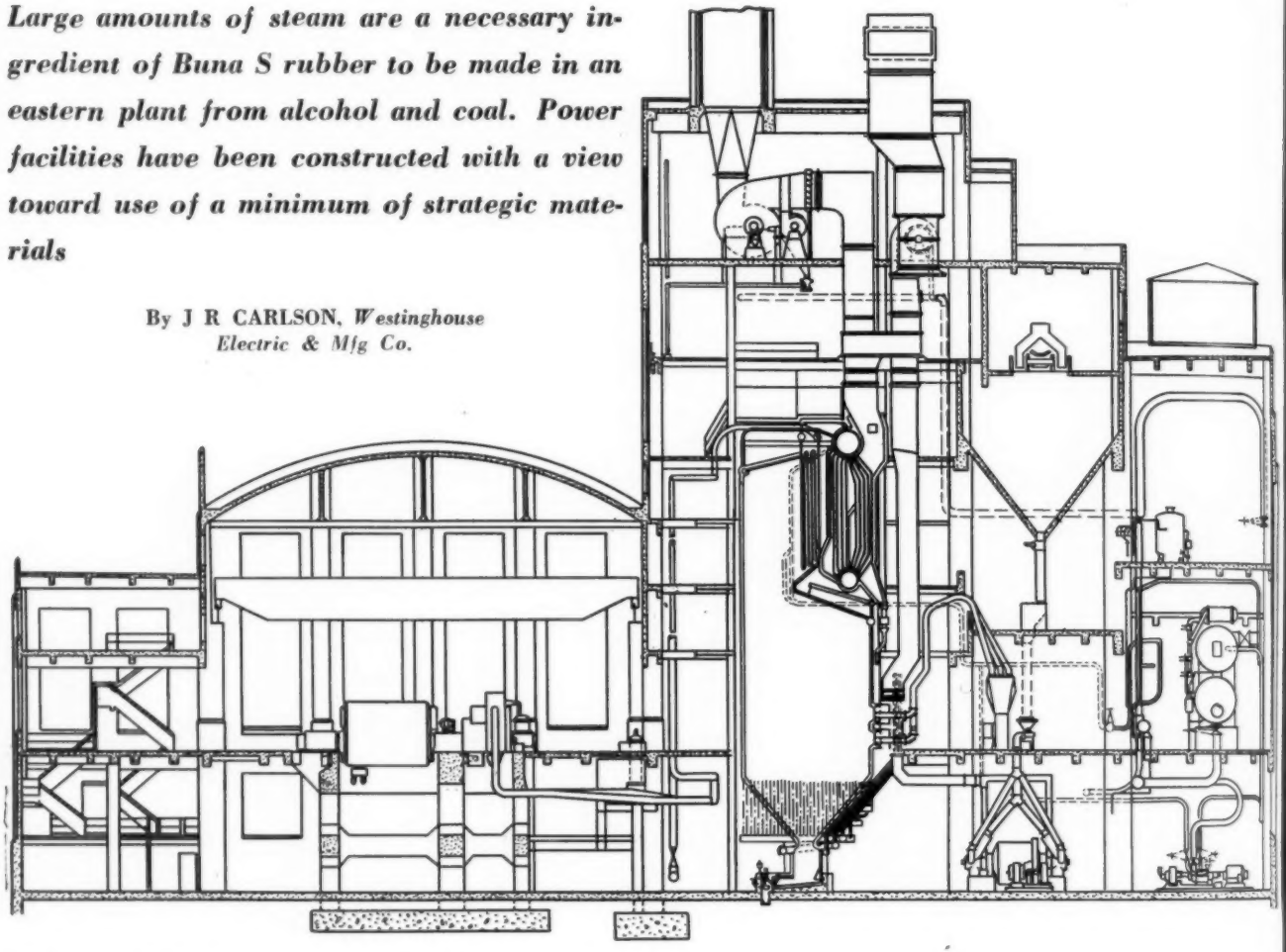
5. Worn or broken parts, removed from service years ago, are being repaired and reused for emergency service. Welding is being used increasingly to repair broken parts. Metal spraying is proving effective when properly applied in building up worn parts, even when they are large parts like turbine casings.

6. Relay-contact replacements are made of salvaged material.

Steam Helps Make Synthetic Rubber

Large amounts of steam are a necessary ingredient of Buna S rubber to be made in an eastern plant from alcohol and coal. Power facilities have been constructed with a view toward use of a minimum of strategic materials

By J R CARLSON, *Westinghouse Electric & Mfg Co.*



Section of reinforced concrete steam plant housing one turbine, three natural-circulation boilers and one forced-circulation unit

► To PRODUCE SYNTHETIC RUBBER on a large scale requires building an entire new industry from the ground up: a chemical-manufacturing business that uses large amounts of process steam and some electric power. Contrary to general opinion, the chemical processes are not new even though quantity production of synthetic rubber is as yet in its infancy. As far back as World War I, several million pounds were manufactured in Europe.

In America, where a plentiful supply of natural rubber has always been available, research in synthetics produced a variety of materials each having certain physical properties superior to the natural variety. Loss of natural rubber supply has posed no problem of discovering new chemical processes but rather one of emergency adaptation of existing plants to synthetic production and rapid construction of new manufacturing facilities.

It takes about 40 lb of steam to make raw materials for a pound of Buna S rubber. In one process, four-fifths of this amount goes to change alcohol to butadiene and one fifth to the process of making styrene from coal and alcohol. In addition, some electric power is needed.

Typical of Buna S plants now under construction is a 100,000-ton-per-year unit for Koppers Co in an eastern State for which the steam and power facilities have been engineered and constructed by Gibbs & Hill, New York. It is scheduled for operation in midsummer, 1943.

Boiler and turbine rooms of this plant, and their contained equipment, present some interesting side lights on conservation of strategic materials in wartime even when high priorities are available for essential construction. The 150-ft-high boiler house, of reinforced concrete construction, rests on 4-ft square concrete columns. A minimum of structural steel has been employed throughout. An 80-ft-span concrete arch roofs the turbine room, and auxiliary power switchgear is located near the boiler-house basement to conserve copper by shortening conduit runs to electrically driven apparatus.

A factor bearing on the capacity of the turbine generator were values in the two 24-in. exhaust lines, this size being the largest available within the time allowed. The permissible flow of steam through lines of this size also approximated plant requirements.

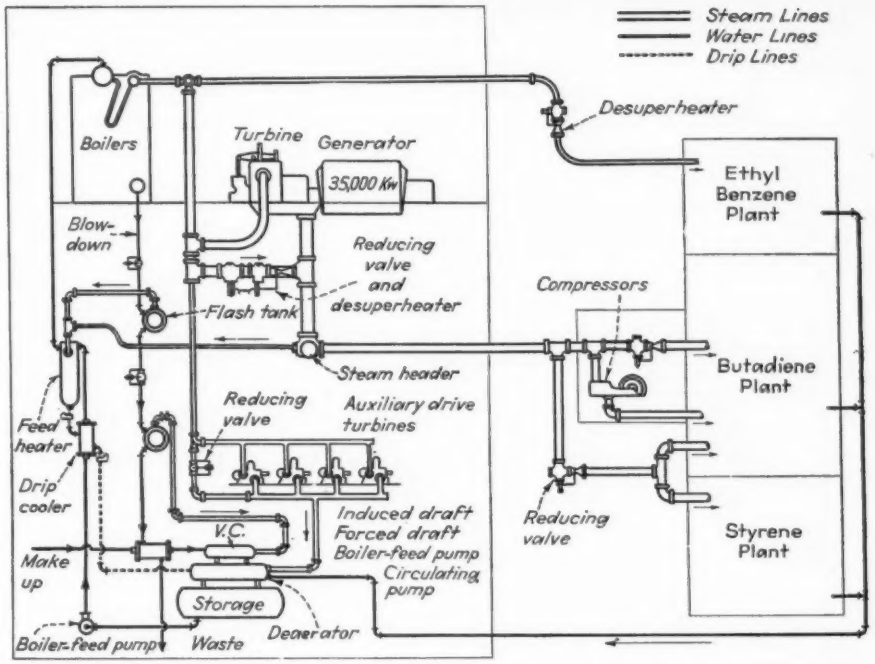
An original plan for two smaller turbines, a normal provision to assure part operation during turbine outage, was

abandoned in favor of a single large turbine with reducing-valve and desuperheater bypass plus a working power-exchange agreement with the local utility. This step saved one turbine from manufacturers' congested production lines.

Five planned-for boilers included one spare. Only four have been installed: three 2-drum natural-circulation boilers and one single-drum forced-circulation unit. Drum plate for the forced-circulation unit is only half as thick as that for the remaining units.

A factor bearing on selection of boiler capacity was the limiting of mechanical draft equipment to single fans per boiler, so as to require a minimum number of reduction-geared turbine drives, an extremely critical item in the war effort. The induced-draft fans have a wheel diameter of 109 in. and their delivery established approximate boiler capacity. Including flyash collection equipment within the fan housing offered minimum use of steel for this purpose.

Flyash so collected is removed to fill by a continuous sluicing system.

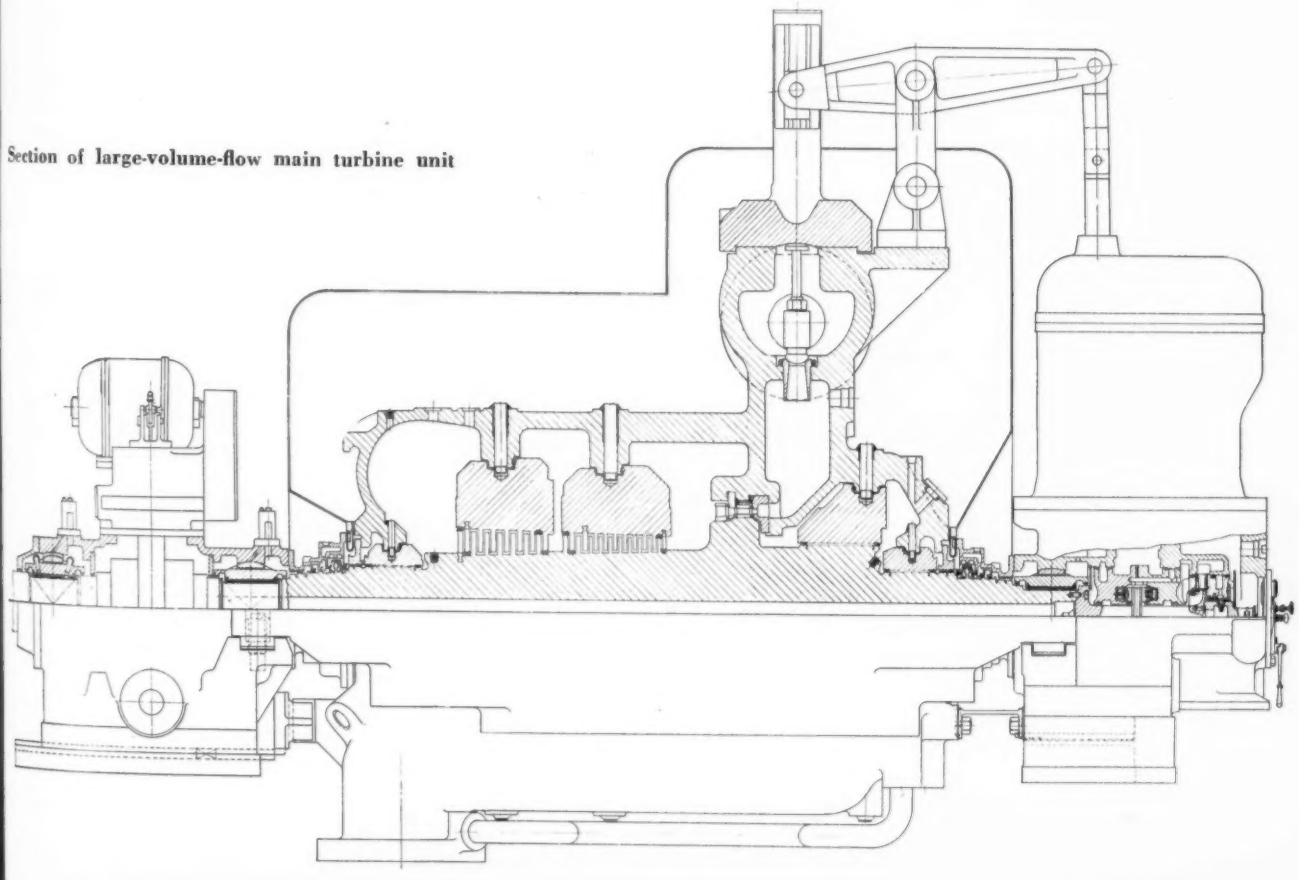


Heat balance arrangement showing flow path of steam through the main turbine, compressor drives, feedwater heating and to process at several pressure levels

Steam conditions of 725 psi, 750 F are sufficiently high to permit generation of nearly twice the electric power requirements of the plant from expansion of the steam through a non-condensing turbine from boiler pressure to that required for process. Because the boilers operate at high makeup (60-80%), conservative steam conditions were selected to keep steam temperature within working limits of carbon-steel superheaters, turbine parts, valves and piping. Evaporators for process steam were rejected as requiring too much critical materials.

Simple 2-stage feedheating arrangement is brought into heat balance by exhaust from 7600 hp of steam turbines, auxiliary drive. These take steam from

Section of large-volume-flow main turbine unit



the main header and exhaust to the deaerator. A reducing valve from the turbine exhaust supplies any slight deficiency. The high-pressure closed heater is supplied principally from main-turbine exhaust supplemented by flash from the blowdown system.

Because of the high makeup, blowdown approaches 10% of total boiler flow. This is flashed at both heater levels before passing through a water-to-water heat exchanger to heat 60-F raw feedwater makeup.

Raw water from the Ohio River is treated with cold lime-soda plus ferric sulphate coagulant (to aid in the removal of silica), then passes through a sludge-blanket precipitator and six concrete gravity filters. Second stage in the softening process takes place in six concrete automatically operated carbonaceous zeolite units.

While many of these features are of war-born necessity, ingenious adaptation of existing designs and careful provision of necessary emergency equipment to assure continuous supply of steam to the rubber process are apparent in the execution of this project. Within a few months the nation's synthetic rubber supply will be augmented by this and other large-size producing units.

Centrifugal Pumps Speed Oil Through "Big Inch"

► HUSKY PUMPS are expected to handle a daily flow of 300,000 barrels of oil, beginning in March—just seven months after engineers started blasting and digging along the route of "Big Inch," largest oil-carrying pipeline ever constructed. They laid pipe over hill, over dale—under water, too—from Longview, Texas to New York and Philadelphia, by way of Norris City, Illinois. Petroleum began to flow through the 530-mile section from Texas to Illinois about the middle of February; the 838-mile section from Illinois to the East Coast is scheduled for completion this summer.

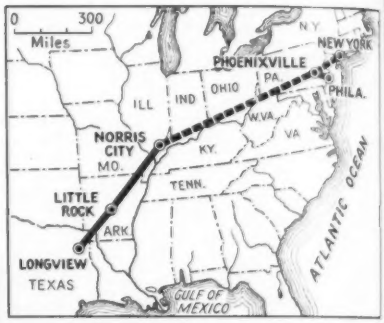
Pipe: Diameter of "Big Inch" is 24 in.; steel is $\frac{3}{8}$ in. thick; the 40-ft sections each weigh about two tons. Right of way is 50 ft wide. Pipe had to be bent to follow contour of the land.

Pumps: At each of ten stations from Texas to Illinois, three 1500-hp motor-driven centrifugal pumps, arranged in series, pump petroleum products through the line. They are single stage, split casing, of special high-pressure design. On the 1368-mainline there will be 26 stations, with three pumps at each station. They will be direct driven by electric motor, speed 1800 rpm.

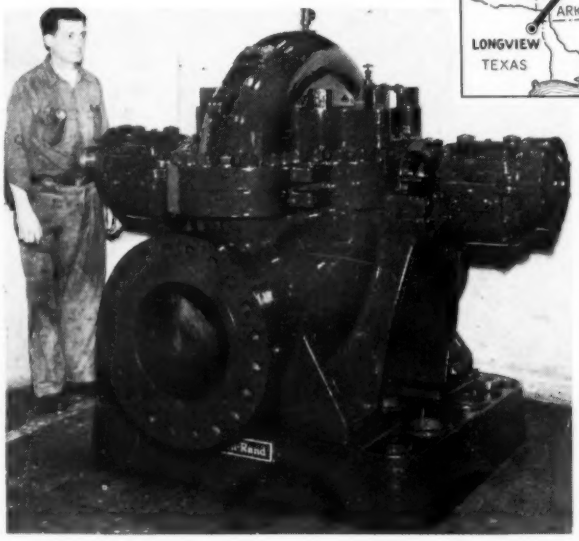
Oil: The 300,000-barrel daily flow of oil from Texas to Illinois provides from 125,000 to 175,000 barrels additional at the East Coast by shortening the tank-car haul. The line's capacity equals the average daily delivery capacity of 25,000 railroad tank cars. Extension of the line to the New York-Philadelphia areas will make the full carrying capacity of the line (300,000 barrels daily) available to the markets of the East.

Cost: Uncle Sam is paying about 95 million dollars for the 1368-mile line. The Reconstruction Finance Corporation is financing it.

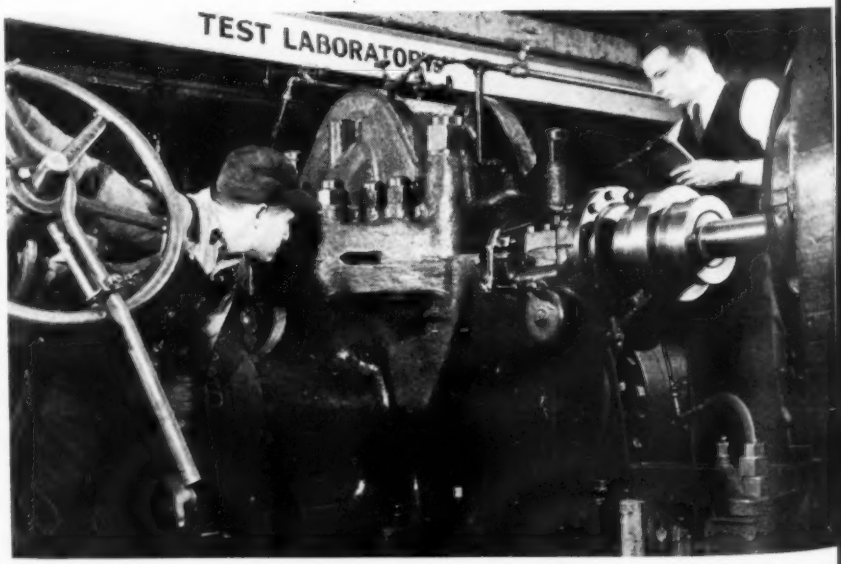
Two-year review: Early in 1941, Secretary Ickes recommended the line and in June, 1942 WPB approved it, authorizing the allocation of 137,500 tons of steel for the Texas-Illinois section; seven contractors signed contracts for this section on July 15, 1942. Two days later the first pipe was shipped from the National Tube Company, Lorain, Ohio. Actual construction work began August 3, 1942.



Completed line from Texas to Illinois already is helping to shorten tank-car haul to East coast. Work on dotted section proceeds at record rate



Three of these Ingersoll-Rand pumps operate in series to produce 770 psi head at pumping stations for War Emergency Pipelines, Inc



One of twenty big centrifugal pumps on test in Allis-Chalmers laboratory. Later they were installed at the stations between Texas and Illinois

Correct Selection Prevents Gear Speed-Reducer Headaches

W F Plume, Philadelphia Gear Works, compares the characteristics of different designs of gear speed reducers and shows how horsepower, speed-ratios, thermal capacity, gear arrangements and motor speed influence selection for a given application

▶ A GENERAL REVIEW of the inherent characteristics of various gear speed reducers makes proper selection a fairly simple matter. Usually speed, horsepower and load cycles of the driven machine are known so that correct size can be selected. Then an intelligent choice of type of gearing may prevent many operating headaches.

In general, any gear unit has a well-established range of sizes and ratios as built by various manufacturers, see Table I. This table gives first a general grouping of gear types, then lists the properties of each. The ratio and horsepower limits are not definitely fixed, but the values tabulated show the prevailing trend of gear manufac-

TABLE I—Types, Speed Ratios, Horsepower Ratings, and Efficiency of Gear Speed Reducers

GENERAL GROUP	TYPE	GEAR-RATIO LIMITS		HORSEPOWER CAPACITY		Approx. Eff, %
		Smallest Size	Largest Size	Smallest Size	Largest Size	
I Helical or Herringbone Gears (Horizontal output shaft only)	(A) Single reduction	1.7:1 to 10:1	1.7:1 to 10:1	18 hp @ 1.7:1 2 hp @ 10:1 (1750 rpm input)	2800 hp @ 1.7:1 450 hp @ 10:1 (870 rpm input)	98
	(B) Double reduction	10:1 to 67:1	10:1 to 67:1	10 hp @ 10:1 1.5 hp @ 67:1 (1750 rpm input)	1200 hp @ 10:1 190 hp @ 67:1 (870 rpm input)	96
	(C) Triple reduction	60:1 to 300:1	60:1 to 300:1	3 hp @ 60:1 0.5 hp @ 300:1 (1750 rpm input)	530 hp @ 60:1 110 hp @ 300:1 (1750 rpm input)	94
II Spiral-Bevel Gears (Horizontal or Vertical output shaft)	(A) Single-(Spiral-Bevel)	1:1 to 5:1	1:1 to 5:1	10 hp @ 1:1 5 hp @ 5:1 (1750 rpm input)	800 hp @ 1:1 300 hp @ 5:1 (870 rpm input)	98
	(B) Double-(First set spiral-bevel, second set helical)	5:1 to 40:1	5:1 to 40:1	3 hp @ 5:1 0.2 hp @ 40:1 (1750 rpm input)	1000 hp @ 5:1 200 hp @ 40:1 (870 rpm input)	96
	(C) Triple-(First set spiral-bevel, next two sets helical)	40:1 to 300:1	40:1 to 300:1	3 hp @ 40:1 0.4 hp @ 300:1 (1750 rpm input)	200 hp @ 40:1 40 hp @ 300:1 (870 rpm input)	94
III Worm and Gears (Horizontal or vertical output shaft)	(A) Single-(Worm and Gear)	4:1 to 60:1	7:1 to 80:1	1.5 hp @ 4:1 0.2 hp @ 60:1 (1750 rpm input)	250 hp @ 7:1 30 hp @ 80:1 (1750 rpm input)	See Curve Fig. 1
	(B) With Helical Attachment (First set Helical, second set worm and gear)	35:1 to 270:1	35:1 to 360:1	0.7 hp @ 35:1 0.1 hp @ 270:1 (1750 rpm input)	130 hp @ 35:1 20 hp @ 360:1 (1750 rpm input)	See Curve Fig. 1
	(C) Double (Two sets Worm and Gear)	35:1 to 3600:1	50:1 to 6400:1	0.2 hp @ 35:1 0.005 hp @ 3600:1 (1750 rpm input)	100 hp @ 50:1 3 hp @ 6400:1 (1750 rpm input)	See Curve Fig. 1
IV Planetary Gears (Horizontal only in separate reducer. Horizontal or Vertical in Motorized type)	(A) Single Reduction	4:1 to 11:1	4:1 to 11:1	4 hp @ 4:1 2 hp @ 11:1 (1750 rpm input)	140 hp @ 4:1 100 hp @ 11:1 (1750 rpm input)	98
	(B) Compound	11:1 to 22:1	11:1 to 22:1	2.5 hp @ 11:1 1.5 hp @ 22:1 (1750 rpm input)	140 hp @ 11:1 100 hp @ 22:1 (1750 rpm input)	96
	(C) Double reduction	22:1 to 100:1	22:1 to 100:1	2 hp @ 22:1 1 hp @ 100:1 (1750 rpm input)	100 hp @ 22:1 80 hp @ 100:1 (1750 rpm input)	95

TABLE II—Typical Ratings of Herringbone-Gear Speed Reducers

Motor Rpm	Gear Ratios															
	1.78	1.94	2.12	2.45	2.85	3.35	3.76	4.26	4.88	5.25	6.13	6.7	7.58	8.23	9.0	10.4
580	25.2	23.3	20.4	18.4	16.5	14.1	12.0	10.2	8.35	7.03	6.15	5.65	4.45	3.96	3.27	2.8
720	31.3	28.3	26.3	23.0	19.8	16.0	14.2	12.3	10.6	9.1	7.26	6.65	5.25	5.86	4.15	3.24
870	37.4	33.4	31.5	26.6	23.6	19.3	17.3	14.6	12.2	10.9	9.8	8.9	6.3	5.75	4.9	3.88
1150	48.0	42.3	40.0	34.3	29.7	24.4	21.9	18.7	15.7	14.0	11.6	10.4	8.25	7.45	6.37	5.12
1750	72.0	61.5	57.4	48.5	42.2	35.4	31.3	26.5	22.3	20.3	16.3	14.8	12.0	10.7	9.2	7.45

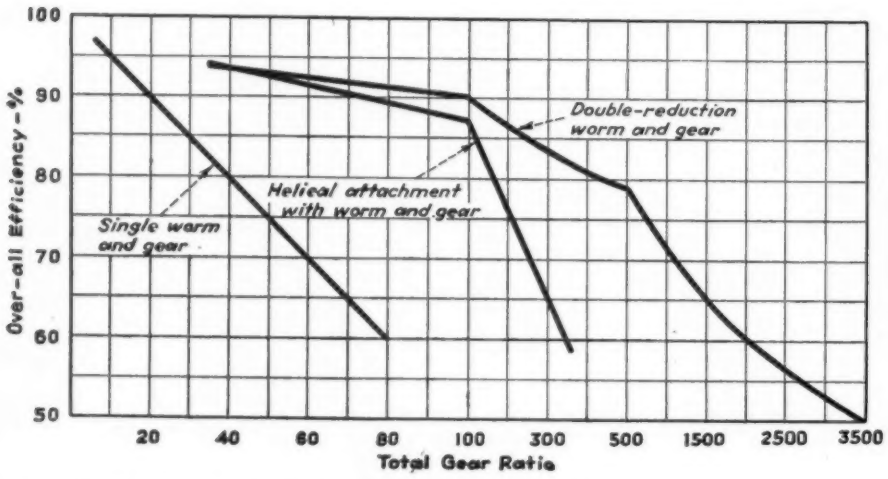


Fig. 1—Efficiency of worm-and-gear drives with their speed ratio

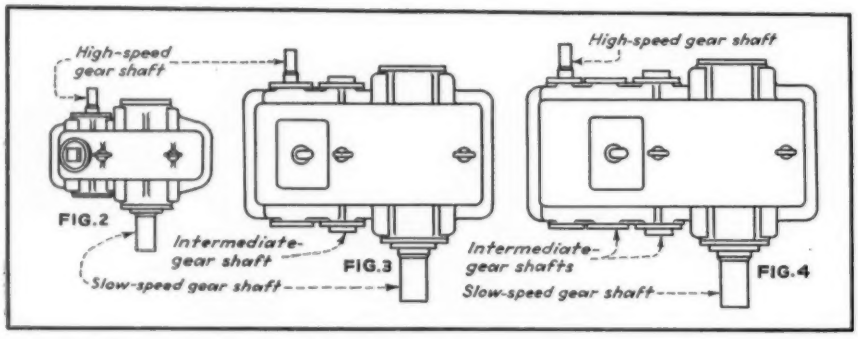


Fig. 2 to 4—Single-, double- and triple-helical- or herringbone-gear-reducers

turers. The ratio limits are in some cases determined by the mechanical aspects of the gears themselves, but in multiple reductions the low limit is determined by the range covered in the previous type.

Efficiencies of all helical, herringbone and spiral-bevel gears are constant over the range of ratios for any one type, but efficiency of a worm and gear varies with ratio. Fig. 1 shows efficiency curves for the three worm-and-gear arrangements.

One of the most important features which determines selection is the arrangement of input and output shafts. Fig. 2 to 18 show outline drawings of all the types listed in Table I, except the planetary designs. In these all high-speed shafts are horizontal. This means that parallel-shaft or concentric-shaft (planetary) speed reducers are not used for vertical drives except in the motorized type. Right-angle units are made in both horizontal and vertical drives.

The planetary-gear speed reducer is best suited to the motorized construction. The round gear frame blends into the round motor frame and makes a compact neat-looking unit.

A characteristic found only in the worm and gear is that it can be made *self locking*. This means that torque applied to the low-speed shaft by the connected machine cannot drive the worm and gear. There are two conditions that may exist: First, if the machine is at rest, and torque applied to the low-speed shaft does not turn it, the machine is *self locking at rest*. In many cases the worm is in motion at the time torque is applied to the output shaft. If, under this condition the machine comes to rest, the gear is considered *self locking in motion*. In order to meet this latter condition the over-all running efficiency of the unit must be 50% or less. For self locking at rest the static efficiency must be 50% or less, the running efficiency higher.

Fig. 1 shows an efficiency of 60% or better for the ratios covered in the single wormgear reduction. These efficiencies are based on small worm diameters. When the self-locking feature is required, worm diameters can be increased to give 50% efficiency for ratios as low as 30:1.

Speed-Reducer Selection

As an example showing how these data apply in the selection of a gear speed reducer assume an ore conveyor inclined upward 15 deg with its head shaft driven at 25 rpm. Estimates show that 8-hp input is required to drive at the head shaft and that operation is 8 hr per day, 300 days per year. The head shaft in this installation is too high above floor level for direct connection to the power unit without expensive construction. Therefore, we locate the gear at floor level and connect its output shaft to the conveyor head shaft by a roller-chain drive.

Because of their higher efficiency and power factor and lower cost a 1160- or 1750-rpm, preferably 1750-rpm, squirrel-cage motor should be selected. These motor speeds require an over-all speed ratio of gear and chain of 1160:25 or 1750:25, that is, 46.5:1 or 70:1. If a chain ratio of 2:1 is selected then the gear speed-reducer ratio will be either 23.25:1 or 35:1.

As the conveyor is inclined upward its load will tend to run it backward when stopped, therefore some means must be provided for holding the load. Worm-and-gear units can be made self locking, but any other gear unit requires some means of preventing backward drift of the conveyor, such as a back-stop or solenoid brake. Checking over Table 1 we find that any of the following drives falls within the required ratio and size limits: double-reduction herringbone; double-reduction spiral-bevel-helical; single-reduction worm and gear; or double-reduction planetary. Efficiency of any of these units can be made 96%, with the exception of the worm and gear. The chain drive can be assumed to have the same efficiency, making the over-all efficiency of the drive 96 × 96 ÷ 100 = 92%.

Then, the required output of the motor is 8 ÷ 0.92 = 8.7 hp, therefore a 10-hp motor will be used and the speed reducer selected on this basis, using the proper service factor. A 1750-rpm 10-hp squirrel-cage motor has a full-load efficiency of 89% and a 0.88 power factor compared to 86% efficiency and 0.87 power factor for a 1160-rpm motor. In addition, the higher-speed motor will cost about 25% less than the slower-speed unit and should therefore be selected. It must, however, be equipped with a solenoid brake; or a backstop must be incorporated in the drive.

Worm-and-Gear Drive

The worm and gear can be made self locking at an efficiency of about 50%. This means that the drive will have an over-all efficiency of 96 × 50 ÷ 100 = 48% and the required motor output will be 8 ÷ (48 ÷ 100) = 16.7 hp, which means that a 20-hp motor must be selected. Now it becomes a matter of comparing the first cost of the 10-hp motor, including its gear-reducer unit and brake or backstop, with that of the 20-hp motor and worm and gear, and also of comparing the power cost for the two. The difference in cost of the units installed is about $100 in favor of the 10-hp equipment. This conveyor would require a backstop that would increase its cost approximately $200, making a total of $100 in favor of the worm and gear. However, the increased power consumption for the worm and gear would soon exceed any saving in first cost.

The 10-hp motor has an efficiency of 88% and it must deliver 8.7 hp to the gear input shaft. Then the motor input is 8.7 ÷ (88 ÷ 100) = 10 hp approximately, or 10 × 746 ÷ 1000 = 7.5 kw input to the motor. The 20-hp motor will be loaded to 16.7 hp, at an efficiency of 90%. The motor input will then be 16.7 ÷ (90 ÷ 100) = 18.5 hp or 18.5 × 746 ÷ 1000 = 13.8 kw, a difference of 13.8 − 7.5 = 6.3 kw against the worm and gear.

If the units operate 8 hr per day for 300 days per year the increased power input to the worm and gear will be 6.3 × 8 × 300 = 15,120 kwhr, which at 2 cents per kwhr costs 15,120 × 0.02 = $302.40. This increased cost for power in one year is about three times the saving in original cost and makes the 10-hp unit by far the most economical, even with power at 0.5 cents per kwhr. Of course, there is no rea-

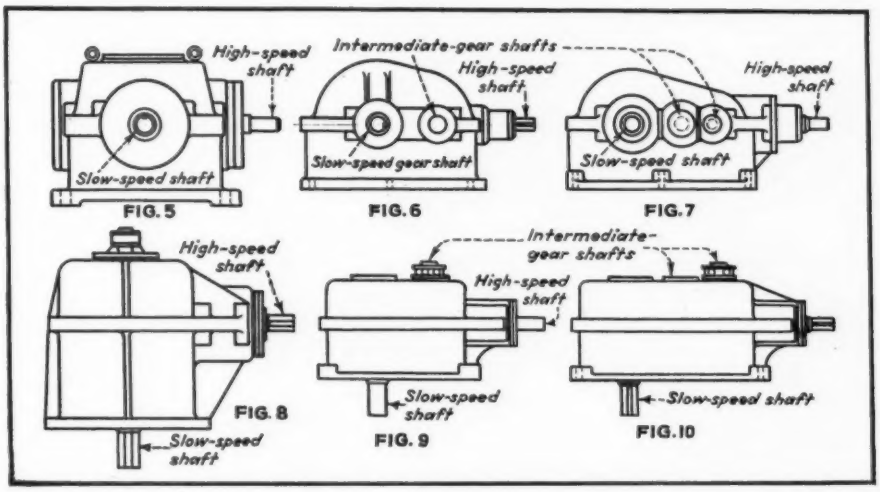


Fig. 5—Single-reduction spiral-bevel-gear speed reducer. Fig. 6—Double-reduction speed reducer with first set spiral-bevel and second set helical gears. Fig. 7—Triple-reduction speed reducer with first set spiral-bevel and second and third sets helical gears. Fig. 8—Single-reduction spiral-bevel gears with vertical slow-speed shaft. Fig. 9—Double-reduction speed reducer with first set spiral-bevel, second set vertical-shaft helical gears. Fig. 10—Triple-reduction gear speed reducer with the first reduction made through spiral-bevel, second and third reductions through vertical-shaft helical gears

TABLE III—Typical Ratings of Worm-and-Gear Speed Reducers

Worm Rpm	Ratio																					
	3⅝	4⅘	5⅝	7⅕	8¾	9¾	11⅔	13⅓	15⅓	17½	19½	22½	24½	27½	30½	35	40	45	50	60	70	80	90
100	22.0	20	18	16	14.0	13	11.2	10.2	9.0	8.0	7.3	6.4	5.9	5.5	5.2	4.3	3.8	3.4	3.1	2.6	2.3	2.0	1.8
200	35.0	31	29	26	23.5	22	19.0	17.2	15.5	14.0	12.6	11.2	10.3	9.4	8.7	7.3	6.4	5.7	5.2	4.4	3.8	3.3	3.0
300	44.0	40	37	33	30.0	28	24.0	22.0	20.0	18.0	16.3	14.4	13.3	12.0	11.2	9.5	8.5	7.5	6.8	5.7	5.0	4.4	3.9
580	60.5	55	52	47	42.0	39	34.5	32.0	28.5	26.0	23.5	21.0	19.3	17.5	16.3	13.7	12.0	10.7	9.7	8.2	7.1	6.2	5.6
720	68.0	62	58	52	47.0	44	38.0	35.0	32.0	29.0	27.0	23.5	22.0	20.0	18.4	15.5	13.8	12.2	11.0	9.2	8.0	7.0	6.3
870	74.0	68	63	57	51.0	48	42.0	39.0	35.0	31.5	29.0	26.0	24.0	22.0	20.0	17.2	15.0	13.5	12.0	10.2	8.8	7.7	6.9
1150	80.0	73	68	62	56.0	52	46.0	42.0	38.0	35.0	32.0	29.0	27.0	24.0	23.0	19.0	17.0	15.0	13.6	11.4	10.0	8.7	7.8
1750	90.0	83	78	71	65.0	61	53.0	49.0	45.0	41.0	37.5	33.0	31.0	28.0	26.0	22.0	19.5	17.3	15.5	12.9	11.2	9.7	8.7
Thermal	74.0	64	58	52	47.0	44	38.0	35.0	31.5	28.5	26.0	23.5	21.5	19.7	18.3	16.0	14.2	12.8	11.6	9.9	8.5	7.5	6.7

son why a standard worm and gear cannot be used with a backstop; such a unit would have an efficiency of about 82.5%. Where space permitted installing a right-angle unit only, the worm and gear might be the one to select.

A vertical drive is desired for a paint mixer requiring 1 hp at 13 rpm. In this installation the most practical is a ring-base unit. This eliminates consideration of any but the vertical motorized planetary units. Any other reducer driven by a horizontal motor would require an awkward, expensive mounting structure.

Types of Gear Units

Any number of cases could be reviewed but for any application the selection can usually be narrowed down to two or three types. In many applications only one may be used. The helical or herringbone types of group I cover the widest range of sizes and ratios. They are efficient and are simple in design, but cannot ordinarily be used for vertical drives.

Group II is versatile in application. Single-reduction spiral-bevel gears are the only right-angle drive for ratios from 1:1 to 4:1. The single and double reductions are often used in place of single-reduction worm-and-gear drives for ratios of 4:1 to 80:1, because of their higher efficiency. Since the useful work is done at the low-speed shaft, a worm-and-gear drive requires more horsepower input than a spiral-bevel-helical drive. This may require a larger frame motor, which will increase both first and operating costs.

Worm-and-gear units of group III are preferred for many applications because of the simplicity of design, the right-angle feature, and the smoothness of operation. As mentioned before, this group is the only one that can be made self locking. There are also many applications where some intermediate condition will act as a partial brake on the output shaft. For ratios up to about 40:1 the efficiency is quite high. But for higher ratios a worm and gear with helical attachment or a double worm and gear should be considered. Fig. 1 shows the great increase in efficiency which can be gained by splitting the reduction for higher ratios. At 70:1 the single reduction is only 65% efficient, as compared to 92% for a double worm and gear drive. The latter also gives a higher maximum ratio than any other commonly used speed reducer. This makes it suitable for very low-speed drives.

Planetary gears, group IV, are frequently used as separate speed reducers when the concentric shaft feature is desirable, but by far the best use is made of this type in the motorized construction. This gives a complete drive in one machine, without the usual baseplate and coupling. Vertical drives are ring-base mounted, making them suitable for mounting on agitator tanks, machine tools, etc. Horizontal drives can be mounted the same as a motor, and can be direct-connected to line shafts, conveyor shafts and many types of machines.

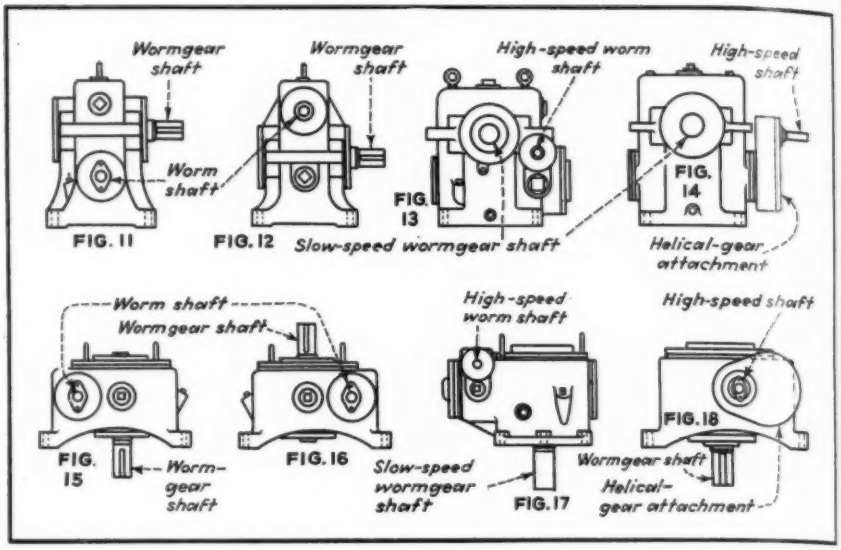


Fig. 11—Single-reduction worm and gear, worm below gear. Fig. 12—Single-reduction worm and gear, worm above gear. Fig. 13—Double-reduction worm-and-gear speed reducer. Fig. 14—Double-reduction speed reducer, first set helical gears and second set worm and gear. Fig. 15 and 16—Single-reduction worm-and-gear speed reducer with worm gear shaft vertical. Fig. 17—Double-reduction worm-and-gear speed reducer with slow-speed-gear shaft-vertical. Fig. 18—Double-reduction speed reducer, first set helical gears, second set worm and gear with vertical wormgear shaft

Thermal Ratings

Efficiency of a gear drive is the ratio of its output horsepower to input horsepower. The difference between input and output horsepower is transformed into heat and must eventually be radiated from the gear case. For applications on which normal radiation will not dissipate the heat at a safe temperature rise, an oil cooler must be added. This is usually in the form of a liquid heat exchanger through which water flows to carry off the heat.

Without an oil cooler the ability of a gear unit to dissipate heat depends on the square feet of exposed gear-case area. The heat generated in Btu is proportional to the horsepower input times the percent power loss.

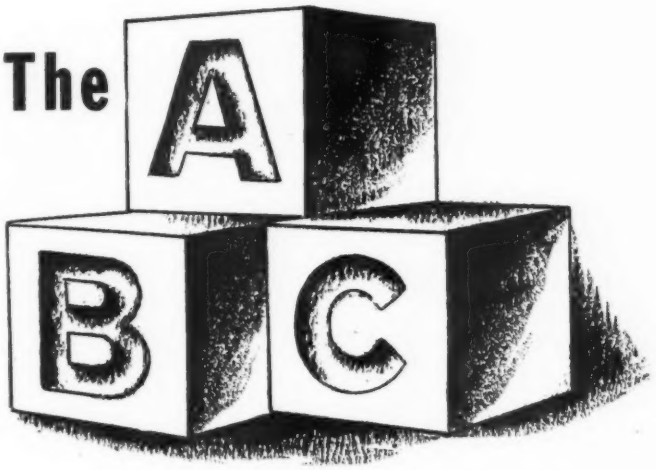
Therefore gear units with constant efficiency over their range of ratios will have a fixed thermal horsepower. This is the maximum horsepower that they can transmit without using an oil cooler, because the percent loss and heat radiating surface are constant.

Table II shows typical ratings taken from a herringbone-gear speed-reducer catalog. Mechanical ratings are higher for higher input speed and lower ratios. For example, in the second column from the left the ratio is 1.78. With a motor speed (gear-input speed) of 580 rpm the unit is rated 25.2 hp. At 1750 rpm this rating increases to 72.0. At a ratio of 10.4, in the right-hand column, the horsepower rating at 580 rpm is only 2.8 and at 1750 rpm 7.45 hp.

This unit has a casing that will satisfactorily dissipate the heat from the lubricating oil when loaded up to 30 hp. Therefore, a heavy black line is drawn to separate all ratings higher than 30 hp from those of less than 30 hp. Any rating to the left of and below the heavy black line applies only when a cooler is used or, without a cooler, only when operation is intermittent (15 min per hr). If the unit runs continuously without an oil cooler for conditions under the heavy line, keep its rating to 30 hp or less.

For worm-and-gear units the efficiency varies with the gear ratio. Therefore the percent power loss changes with each ratio while the gear-case heat-radiating surface remains constant. This gives a different thermal horsepower rating for each ratio, given across the bottom of Table III. When this unit is used continuously for a rating higher than the thermal rating an oil cooler must be provided. In some installations a change in gear type may save the expense of installing and operating an oil cooler.

The ABC of Scrap Collection



To insure enough metals and other scarce materials to lick the Axis, the War Production Board is asking top management everywhere to "get in the scrap" from American industry. That's why every power man will find that industrial scrap collection is a regular and important part of his job right through 1943

A is for Axis—sole reason for scrap drives

B is for Babbitt—bearing alloy worth its weight in silver; for Boiler (unused)—tons of good scrap if nobody needs it for wartime steam generation; for Brass—precious war metal which should be put to work or sent back to the melting pot

C is for Cable—big copper source; for Chain—good scrap for steel mills; for Compressor (discarded)—source of iron, steel and bearing metals; for Conveyor—combination iron mine and rubber plantation if ready for discard; for Copper—a metal so precious the government has installed 20,000 tons of solid silver for busbars, just to save copper

D is for Dormant Scrap—machines, tools and equipment not now doing essential work or scheduled for such duty within three months; for Ducts (old or inactive)—worth scrapping

E is for Electrical Equipment—a major source of good iron, steel, copper and rubber

F is for Fans—equipment that should be doing war work—either moving air or melting scrap

G is for Generators—equipment that should be making kilowatts or feeding the metal-melting furnaces

H is for Hose (worn)—always good scrap, whether metal or rubber

I is for Iron (cast or wrought—a primary source of heavy scrap for steel

J is for Junk—often a low-grade name for high-grade scrap

L is for Lead—good bullets

M is for Motor—source of mechanical power or good steel and copper; for Mufflers (idle or corroded)—sure scrap

N is for Nickel and Nickel Alloy—most valuable scrap, which should not be mixed with cheaper scrap; for Nonferrous Alloy of any type

O is for Oil—material whose failure converts good working machine parts into scrap

P is for pump (unused)—rich potential source of iron, bronze and babbitt; for Packing (discarded)—may be good rubber scrap; for Piping—potential scrap, even when part of a system, if connection is no longer used or needed. (Check your plant)

Q is for Question—best way to get information on scrap drive

R is for Rags, Rope, Rubber—these are all valuable scrap (wash and sort the rags); for Refrigeration Systems—a lot of metal; be sure it's all in use; for Rope (Manila or hemp)—it's scarce; valuable first as rope, then as scrap; for Rope (wire)

S is for Scrap Collection—a job for all industry throughout 1943; for "Spare Parts"—common misnomer for stuff you may never use; for Structural Steel—a major source of heavy scrap as found in discarded buildings, water towers, tracks, etc.; for Stacks (abandoned)—scrap for immediate disposal

T is for Tanks, Tools, Traps, Turbines—such items may spell "tonnage"

U is for Unusable Equipment—junk if it can't be used soon

V is for Valve—device used to control flow of fluids; otherwise valuable melting scrap

W is for Welding Electrodes—mostly special alloys; very valuable

X is for the Human Factor(the unknown quantity)—the difference between success and failure in scrap collection

Y is for Year—probable minimum duration of present scrap drive

Z is for Zeal—the chief requirement

How to Calculate Central Station Heat Balance

Armed only with the ability to use steam tables, simple arithmetic and a slide rule, anyone who can work out a theoretical heat drop for adiabatic expansion can calculate feedheating Btu rates

By G B GREGG
Westinghouse Electric & Mfg Co

▶ THE CURVES, TABLES AND METHODS illustrated here can be applied readily to any heat-balance problem involving the regenerative system of feedwater heating. To facilitate computation, each item is given a number reference in the text and referred to by that number throughout text and calculations.

First, sufficient data is given to show what is required to work a heat-balance problem. Second, a sample calculation is detailed in numbers on one page for easy reference. Third, the calculation is worked out step by step with all principal factors taken into account to assure that the calculator makes each step in proper sequence to save time and work.

The information required before starting actual calculation can be separated into six parts: (A) keys to establishing heater pressures and temperatures; (B) turbine performance data at full load and tables for estimating amounts of bled steam; (C) making a heat-balance diagram; (D) calculating heat content of steam at turbine bleed points; (E) calculating heat-balance diagram quantities; and (F) sample outline of steps in the calculation for use as a pattern.

A—Keys to Heater Pressures

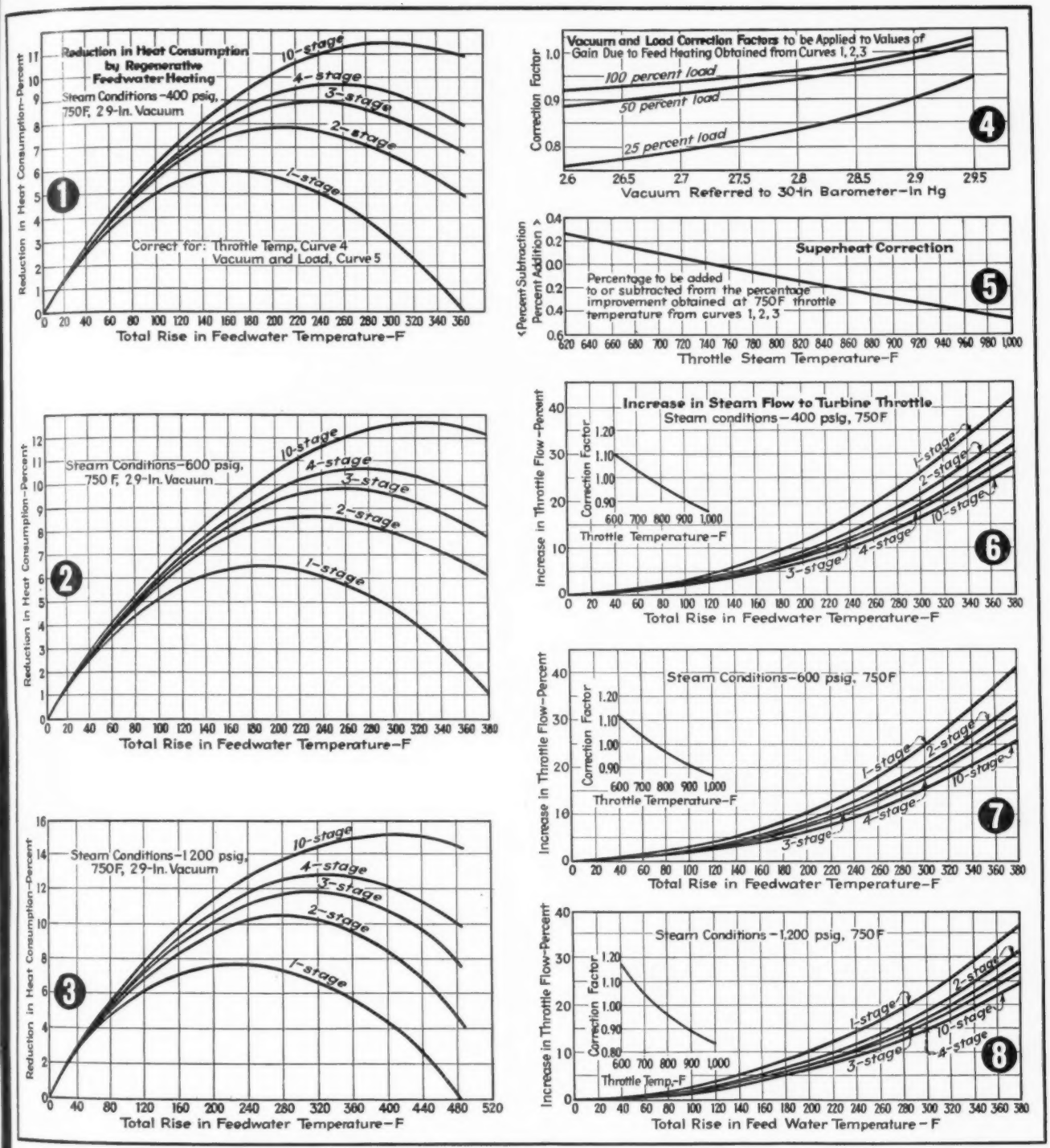
1. Drop in absolute pressure from turbine bleed point to each heater is 5% of pressure at bleed point.
2. Enthalpy, or heat content, of bleed steam entering feedwater heater is same as that at bleed point.
3. Condensate leaving closed heater shell has heat content same as heat of liquid at heater pressure.
4. Feedwater leaving through the tubes of a closed feedwater heater has heat content 5 Btu below No. 3.
5. Each pound of steam going to the air ejector inter and after condenser gives up 1300 Btu to the feedwater passing through it.
6. The amount of makeup which enters the system through the evaporator is 1 to 2% for a central station heat cycle —1½% of the total steam flow is a good figure.
7. The heat content of steam leaving the shell of an evaporator is equal to that at saturation pressure of the evaporator condenser, or feedwater heater, into which it empties.
8. Temperature of feedwater leaving an open heater is same as temperature of saturated steam in heater.
9. Though heat content remains the same, absolute pressure drops approximately 5% over turbine throttle and governor valves.
10. The absolute pressure at each turbine bleed point varies directly with the steam flow immediately beyond the bleed point.

B—Turbine Data

The manufacturer will usually furnish necessary pressure and enthalpy values at bleed points for a given set of steam conditions, such as contained in Tables I, II and III, which show typical quantities and correction factors.

C—Heat-Balance Diagram

1. In addition to main turbine-generator unit and surface condenser, the pieces of equipment described below all enter the feedwater circuit.
2. Number of stages of feedwater heating depend on economics of installation and amount of reduction in heat consumption possible as compared with cost of the feedwater heater equipment. On units below 10,000 kw, usually two or three stages can be justified; at 15,000 to 25,000 kw, three or four stages; and with 1200-1400-psi condensing turbines above 25,000 kw, as many as five stages may be economical.
3. Location of feedwater heaters should be such as to give about equal amounts of steam extracted to each heater. This may be used as a means for selecting which bleed points of a turbine to use when a choice of those points is available.
4. Types of makeup and feedwater-heating equipment are three: *evaporators, closed heaters* and *open heaters. Evaporators* are shell and tube heaters with steam in the tubes and treated makeup, or raw water, in the shell. Steam in the tubes comes from a high-pressure bleed point and the shell is connected to a low-pressure bleed point. Steam leaves the shell in a saturated condition and goes to the next lower-pressure heater or to an evaporator condenser. *Closed heaters* are shell and tube units in which steam bled from main unit in shell is used to heat feedwater in tubes. Condensate from shell may be trapped back to next lower heater or condenser, or pumped by a booster pump into the next higher heater or into the main feedwater line. *Open heaters* are so arranged that steam bled from the main turbine generator unit or exhaust from steam-driven auxiliaries is mixed intimately with the feedwater to be heated. The resulting warmed feedwater is usually fed to the suction of a booster pump or boiler-feed pump.
5. Pumps are of three types: *condensate, booster* and *boiler feed. Condensate* pump removes condensed steam from the condenser. *Booster* pump may be used in the main feedwater circuit either to overcome the pressure losses in the tubes of the closed heaters and supply higher pressure water to the boiler-feed pump suction or to pump condensate from the closed heaters into the main feedwater circuit. *Boiler-feed* pump overcomes the boiler pressure and forces the feedwater in the main circuit through the heaters and into the boiler.
6. Traps are used to discharge con-


Reduction in Heat Consumption by Regenerative Feedwater Heating
Steam Conditions—400 psig, 750F, 29-In. Vacuum
10-stage
4-stage
3-stage
2-stage
1-stage
Correct for: Throttle Temp, Curve 4
Vacuum and Load, Curve 5
Reduction in Heat Consumption—Percent
Total Rise in Feedwater Temperature—F
1
Vacuum and Load Correction Factors to be Applied to Values of Gain Due to Feed Heating Obtained from Curves 1, 2, 3
100 percent load
50 percent load
25 percent load
Correction Factor
Vacuum Referred to 30-In Barometer—In Hg
4
Superheat Correction
Percentage to be added to or subtracted from the percentage improvement obtained at 750F throttle temperature from curves 1, 2, 3
Percent Subtraction
Percent Addition
Throttle Steam Temperature—F
5
Steam Conditions—600 psig, 750 F, 29-In. Vacuum
2
Increase in Steam Flow to Turbine Throttle
Steam conditions—400 psig, 750F
Correction Factor
Throttle Temperature—F
Increase in Throttle Flow—Percent
6
Steam Conditions—600 psig, 750F
7
Steam Conditions—1200 psig, 750F, 29-In. Vacuum
3
Steam Conditions—1,200 psig, 750F
Throttle Temp.—F
Total Rise in Feed Water Temperature—F
8

densed steam from the shells of closed heaters to some point in the system at a lower pressure; i e, the shell of a lower-pressure heater, an open heater or the hotwell of the condenser serving the main unit.

D—Calculating Heat Content

1. Determine straight condensing flow for size unit and steam conditions from Tables I or II by multiplying:

$$\frac{\text{3413 x kw rating of unit}}{\text{adiabatic drop x Rankine cycle efficiency}}$$

2. Determine number of stages desired from a study of curves 1-5 and size of unit.
3. Determine final temperature of feedwater from curves 1-5 for the total number of stages which have been selected.
4. Determine total flow from factor in curves 6-8 times the flow in (*D-1*), above, for number of stages selected.
5. Determine total steam bled for feedwater heating by multiplying (*D-4*) by factor determined by number of stages and final feedwater temperature desired (Curves 9-11).
6. Determine flow to each heater:

$$\frac{(D\text{-}5)}{\text{number of stages}}$$

7. Determine flow through each blade group:
   (a) 1st group = (*D-4*)
   (b) 2nd group = (*D-4*) − (*D-6*)
   (c) 3rd group, = (*D-4*) − 2 x (*D-6*), etc. etc.
   (d) last group = (*D-4*) − (*D-5*).
8. Determine pressure at bleed points on the basis of approximately equal temperature rise for each heater based on zero extraction or obtain bleed-point pressures from turbine manu-

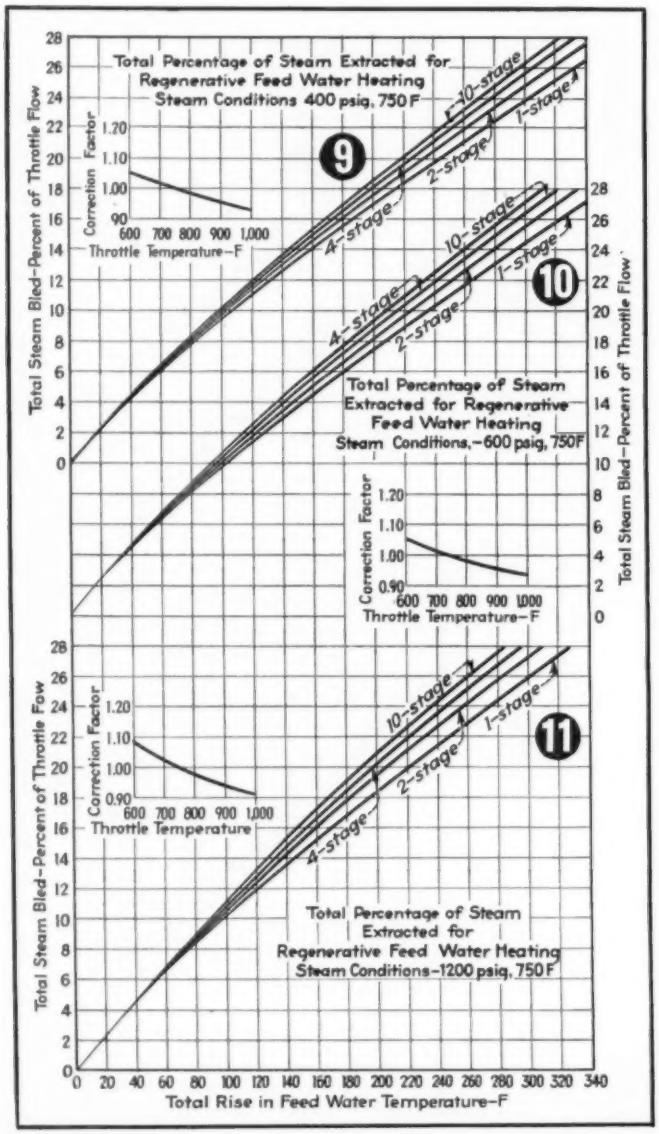
facturer. The absolute pressure at these bleed points will vary with the flow beyond the bleed point.

9. Determine entropy of steam beyond throttle and governing valves, allowing 5% pressure drop from absolute pressure at constant enthalpy (heat content).
10. Determine theoretical heat to work on the basis of constant entropy for each bleed point.
11. Determine internal heat to work for each bleed point by multiplying internal efficiencies from Table III by (*D-10*).
12. Determine heat content or enthalpy at each bleed point by subtracting (*D-11*) from enthalpy at (*D-10*).
13. Determine heat to work for each blade group by subtracting (*D-12*) for first group from enthalpy at throttle, for second group subtract (*D-12*) of second group from (*D-12*) of first group, etc, up to last group of blades. For last group of blades calculate enthalpy of exhaust steam from the condensing steam rate with the assumed mechanical and electrical efficiencies. Then subtract exhaust enthalpy from enthalpy at the low-pressure bleed point for heat for last blade group.

E—Calculating Quantities

1. Determine the temperatures, pressures and heat contents of all steam lines and feedwater lines and label each on the heat-balance diagram with the pounds per hour of steam flow and water flow as calculated up to this point for the arrangements desired.
2. Calculate the actual steam flow to the high-pressure heater based on using item (*D-4*) plus steam to auxiliaries and makeup for total feedwater flow.
3. Calculate evaporator steam flow on the basis of heating all makeup to saturated steam at the pressure corresponding to the next lowest heater which receives steam from the first bleed point below the one which supplies steam to the evaporator.
4. Locate the open heater so that it will receive drains from all heaters when used as a deaerator. Generally the steam supply to the heater comes from a point at which the pressure is above atmospheric pressure down to half load. The condensate is usually fed to closed heaters by boiler-feed or booster pump. Enthalpy of feedwater leaving deaerator is determined from pressure in heater, assuming zero terminal difference.
5. A low-pressure closed heater may be inserted in the line before the open heater. Flow to this heater will be condensed and either pumped into the open heater or trapped into the main condenser hotwell.
6. The air ejector inter and after surface condenser will add 1300 Btu to the system for each pound of steam supplied to the ejector. The heat content of the water leaving this con-

(*Continued on page* 164)


Total Percentage of Steam Extracted for Regenerative Feed Water Heating
Steam Conditions 400 psig, 750 F
9
10-stage
1-stage
2-stage
4-stage
Correction Factor
Throttle Temperature—F
Total Steam Bled—Percent of Throttle Flow
Total Percentage of Steam Extracted for Regenerative Feed Water Heating
Steam Conditions,—600 psig, 750F
10
Total Steam Bled—Percent of Throttle Flow
Total Percentage of Steam Extracted for Regenerative Feed Water Heating
Steam Conditions—1200 psig, 750 F
11
Throttle Temperature
Total Rise in Feed Water Temperature—F

TURBINE PERFORMANCE AND EXTRACTION TABLES

TABLE I

Approx Full Load Rankine Cycle Efficiencies at 100-F Superheat 28-in. Vacuum

Kw Rating	Throttle Pressure psi gage 200	300	400	600	900	Elec Eff	Mech Eff
500	.600	.585	.571	.549	.525	.954	.980
1000	.650	.634	.619	.595	.574	.958	.980
2000	.694	.694	.686	.678	.664	.962	.985
4000	.726	.718	.709	.695	.680	.965	.985
7500	.745	.736	.728	.713	.693	.970	.990

Superheat Corrections			Inches of Mercury		
Corrections —	200 F	300 F	27	28.5	29
	1.019	1.037	1.007	.994	.985

TABLE II

Approx Full Load Rankine Cycle Efficiencies — 10,000 to 60,000 kw

Kw Rating	Base Eff	Superheat Deg F	Superheat Correction	Pressure psi gage	Pressure Correction	Vacuum in.Hg	Vacuum Corr
10,000	.780	0	.926				1.015
12,500	.784	50	.943				1.013
15,000	.789	100	.959	400	.999	2750	1.012
20,000	.793	150	.972	500	.994	2775	1.010
25,000	.795	200	.983	600	.988	2800	1.008
30,000	.797	250	.992	700	.983	2825	1.004
35,000	.799	300	1.000	800	.977	2850	1.000
40,000	.800	350	1.007	900	.971	2875	.990
50,000	.801	400	1.013	1000	.969	2900	.980
60,000	.802	450	1.018	1250	.951		

Multiply Base Eff x Sh Corr x Press Corr x Vacuum Corr=Rankine Cycle Eff

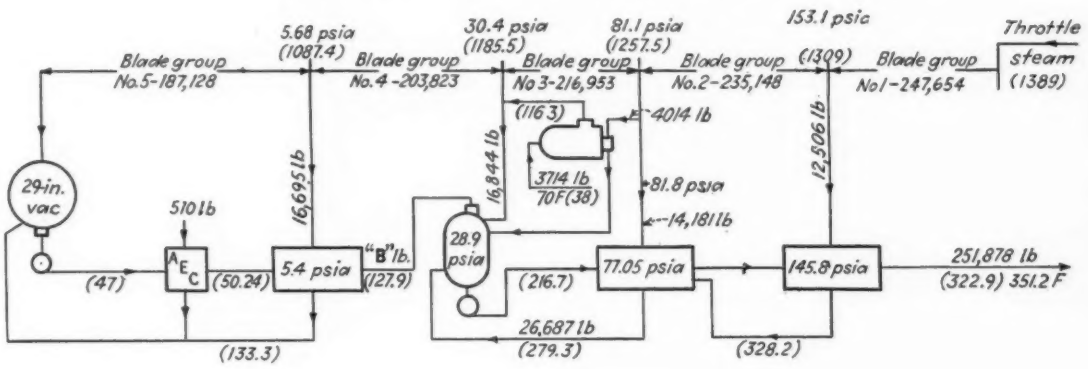
TABLE III

Approx Internal Turbine Efficiencies — 10,000 to 60,000 kw
(Based on Bleeding for Feedwater Heating at Full Load)

Absolute Pressure at Bleed Point	Inlet Pressure 400 psi, gage 600	700	825	Inlet Pressure 600 psi, gage 600	700	825	Inlet Pressure 1200 psi, gage 700	825	900
800							.655	.655	.655
400				.665	.665	.665	.716	.716	.716
300	.660	.660	.660	.692	.692	.692	.736	.736	.736
150	.725	.725	.725	.743	.747	.748	.774	.768	.769
100	.755	.755	.755	.770	.774	.775	.793	.799	.800
50	.790	.793	.796	.795	.801	.811	.810	.819	.823
10	.823	.832	.837	.815	.826	.837	.820	.831	.836
1	.807	.821	.836	.796	.810	.825	.800	.815	.824
0.8	.801	.815	.831	.791	.805	.821	.796	.812	.820
0.5	.785	.800	.820	.776	.792	.811	.785	.802	.811

COMPUTATION SHEET

First trial - 25,000 - kw turbine, - 4 - stage feed heating



REF	CALCULATED DATA
D-1	415 psia - 750 F - 1389 Btu - 1.658 Entropy - 30 F, - sh 29 Vac $\frac{891}{498}$ Btu heat to work $\frac{25000 \times 3413}{498 \times 0.795 \times 1.000 \times 0.999 \times 0.98} = 220,137$ lb per hr
D-263	D-2 - 4 Stages D-3 - 250 F
D-4	Throttle flow - 220137 (1+0.125 x 1) = 247,654 247654 x 1½% - makeup - 3 714 air ejector - 510 Total flow 251, 878
D-566	247 654 x 0.219 = 54,236 lb per hr 54,236 ÷ 4 = 13,559 lb per hr
D-7	247 654 lb per hr Group No. 1 13 559 234 095 lb per hr Group No 2 13 559 220 536 lb per hr Group No 3 206 977 lb per hr Group No 4 193 418 lb per hr Group No 5
D-8	$\frac{234\,095}{220\,137} \times 144 = 153.1$ psia - No 1 Bleed point $\frac{220\,536}{220\,137} \times 81 = 81.1$ psia - No 2 Bleed point $\frac{206\,977}{220\,137} \times 32.3 = 30.4$ psia - No 3 Bleed point $\frac{193\,418}{220\,137} \times 6.46 = 5.68$ psia - No 4 Bleed point
D-9 D-10 D-11 D-12 D-13	0.95 x 415 = 394.25 psia 1389 Btu 1.663 Entropy 1389 153 psia - 1278 111 x 0.721 1389 81.1 psia - 1218 171 x 0.769 1389 30.4 psia - 1139 250 x 0.814 1389 5.68 psia - 1026 363 x 0.831 1389 29" Vac 894 $\frac{495 \times 0.795 \times 0.999 \times 0.98}{0.97 \times 0.99}$

1389	1389
80	1309
1309	80
1389	1309
131.5	1257.5
1257.5	51.5
1389	1257.5
203.5	1185.5
1185.5	72
1389	1185.5
301.6	1087.4
1087.4	98.1
1389	1087.4
401.7	987.3
987.3	100.1

REF	CALCULATED DATA
E-2	$\frac{251878 \times 48.7}{980.8} = 12,506$ lb per hr (h-p htr))
E-3	$\frac{251878 \times 57.5 - 12,506 \times 48.9}{978.2} = 14,181$ lb per hr $\frac{3714 \times 1125}{1040.8} = 4014$ lb per hr (Evaporator)
E-4	$88.88 = 968.6 (217,463 - B) + 3714 \times 946.3$ $B = \frac{30701 \times 62.6 - 216,061,102.6}{1057.4} = 204,333$ lb per hr
E-5	$\frac{5010 \times 1300}{204\,333} = 3.24$ Btu - Rise
E-6	$\frac{204\,333 \times 77.66}{954.1} = 16,695$ lb per hr (1-p htr)
E-7	$\frac{251\,878 \times 1066.1}{25000} = 10,741$ Btu per kw hr
E-8	$247,654 \times \frac{80}{3413} = 5805$ kw $235,148 \times \frac{51.5}{3413} = 3548$ kw $216,953 \times \frac{72}{3413} = 4577$ kw $203,823 \frac{98.1}{3413} = 5858$ kw $187,128 \frac{100.1}{3413} = 5488$ kw
E-9	Power generated 25,276 kw
E-10	$\frac{25000}{0.97 \times 0.99} = 26033$ kw Required
E-11	$\frac{26033}{25276} = 1.028$ Multiplier ① Use multiplier on all flows ② Readjust pressures ③ Rework for closer balance if desired

G B Gregg

Sample Outline of Steps in Calculating a Four-Stage Heat Balance

This is a typical problem. Any problem from one to ten stages of feed heating can be worked from the preceding data. Assume the following data have been obtained from the turbine manufacturer: 25,000-kw condensing turbine-generator unit designed for four stages of feed heating and steam conditions of 400 psi gage, 750 F, 29 in. Hg vacuum. Absolute pressures at bleed points at full-load straight condensing operation without bleed are 144, 81, 34.4 and 7.4 psi.

Electronic Adjustable-Speed Drive Gives Wide Operating Range

► Operation of an automatic lighting control, installed about 1928, was one of the earliest applications of electronic motor control. Thyratron tubes were used here to supply both the field and armature of a small motor to control its speed over a range of approximately 100 to 3600 rpm. Following this, many thyratron speed-control equipments were furnished for motors of various sizes and for many different industrial applications.

The primary function of practically all of the original motor controls has been to adjust the speed of the motor. The other requirements, such as starting and accelerating, have been obtained largely through the use of various combinations of conventional control devices. A few equipments have been supplied for holding motor speed constant, but in general their principal function has been to supply smooth, adjustable speed.

Thymotrol Speed Control

There are in service a relatively large number of thyratron motor-speed controls and there are many applications in industry for such equipment. Generally speaking, these equipments consist of an adjustable-voltage rectifier using thyratron tubes to supply direct current for the motor field and armature. By varying the output voltage of the tubes the speed of the motor can be changed.

Experience with this equipment has led to the development of the Thymotrol system. This control in combination with a suitable motor provides an adjustable-speed drive with features not ordinarily found in other conventional drives. The standard drive consists of an anode transformer, a control and rectifier panel, a pushbutton station or other control accessory, and a direct-current shunt motor. In some instances, a smoothing reactor may also be required, depending on size and characteristics of the motor. Ordinarily, a 230-volt motor makes more economical use of the rectifier tubes. Although the motor may be of conventional design, its characteristics must be such that it will operate satisfactorily from an unfiltered rectifier supply. This is particularly true when the ac power supply is single phase.

Operation of the equipment can best be understood by considering Fig. 3. In this figure, tubes *A* and *B* form a full-wave rectifier that converts alternating current, supplied by the anode transformer, to direct current, for the armature circuit. Likewise, tubes *C* and *D* form a full-wave rectifier to supply direct current to the motor shunt-field circuit. By varying the outputs of these two rectifiers, operation of the motor is controlled. Its speed can be increased by armature-voltage control from zero to maximum for this part of the control, and then by field weakening the speed can be further increased to the maximum for which the particular motor is designed.

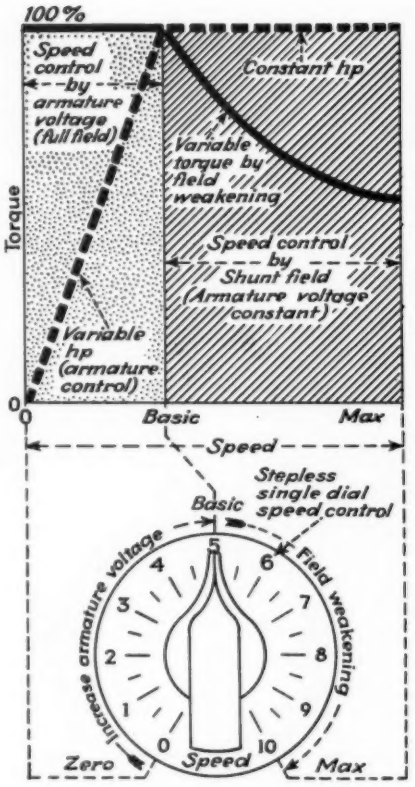
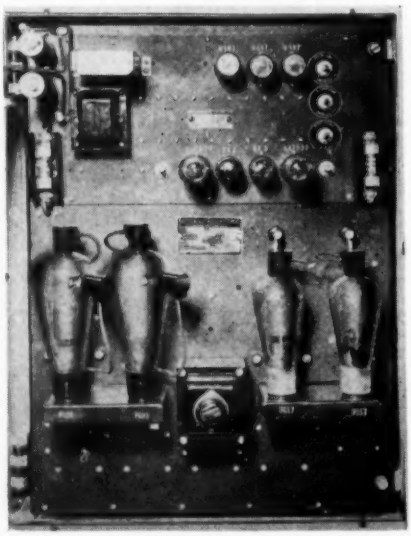


Fig. 1—Curve shows how motor torque and horsepower vary with motor speed, when speed-control dial at bottom is turned from zero to maximum

■

Fig. 2—Thymotrol panel, which with heavy-duty pushbutton station, an anode transformer and a direct-current motor comprises standard equipment



A group of radio-type control tubes regulates the output of the power rectifiers. Acting as amplifiers of current and voltage signals received from the motor circuit, these tubes supply the necessary direct current to vary the output voltage of the power rectifiers by a phase-shift method to give the desired motor performance.

When the motor is operating at speeds below basic, it has full-field and reduced-armature voltage and provides constant torque. Horsepower output decreases in proportion to the decrease in speed. When operating at speeds above basic, the motor has full-armature and reduced-field voltage and gives constant horsepower and reduced torque output, as in Fig. 1.

Fig. 1 also illustrates how the speed is increased by armature voltage, as the speed-adjusting potentiometer is turned from zero to midposition, and how the motor operates by field weakening from midposition to the point where the knob is turned to the extreme clockwise position.

Control-Panel Equipment

Fig. 2 shows a conventional control panel. It consists of a suitable base on which are assembled the control and power tubes, a line contactor, a thermal-overload relay, a field-failure relay, a cathode-protective timer and the necessary transformers, together with other material required for the electronic circuit. Suitable anode fuses are provided for protection against short circuits.

For many applications, it is desirable to preset the speed at which the motor is to operate anywhere within the op-

S D Fendley, industrial control division, General Electric Co, describes operation and performance of an electronic-tube system of automatic direct-current-motor control on alternating-current systems that provides smooth acceleration during starting, an adjustable-speed range from zero to maximum, and close speed regulation

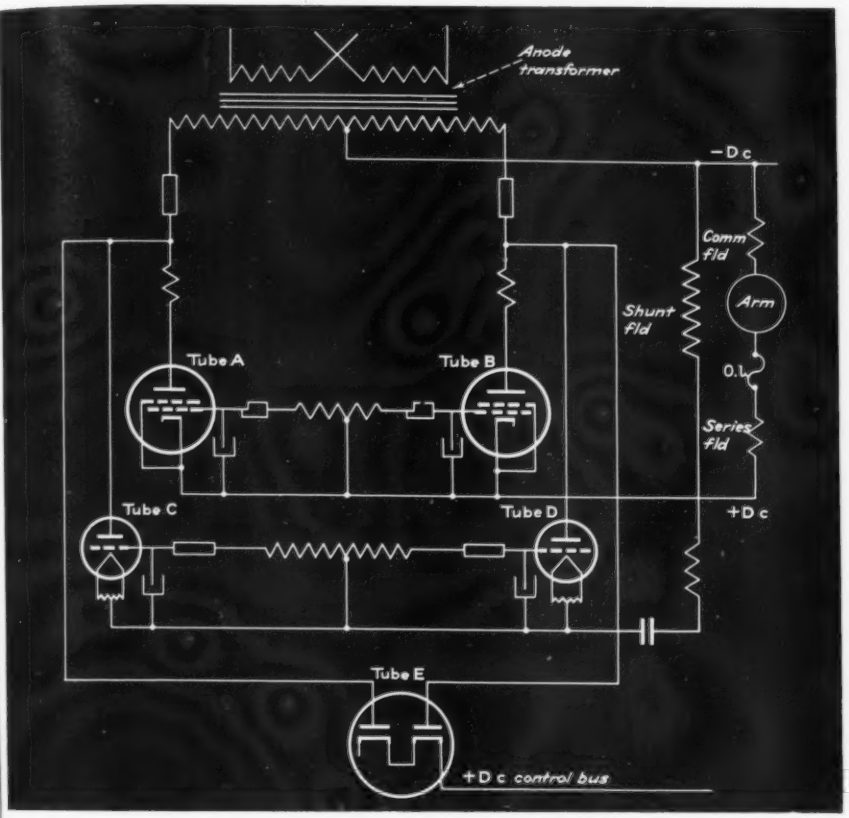
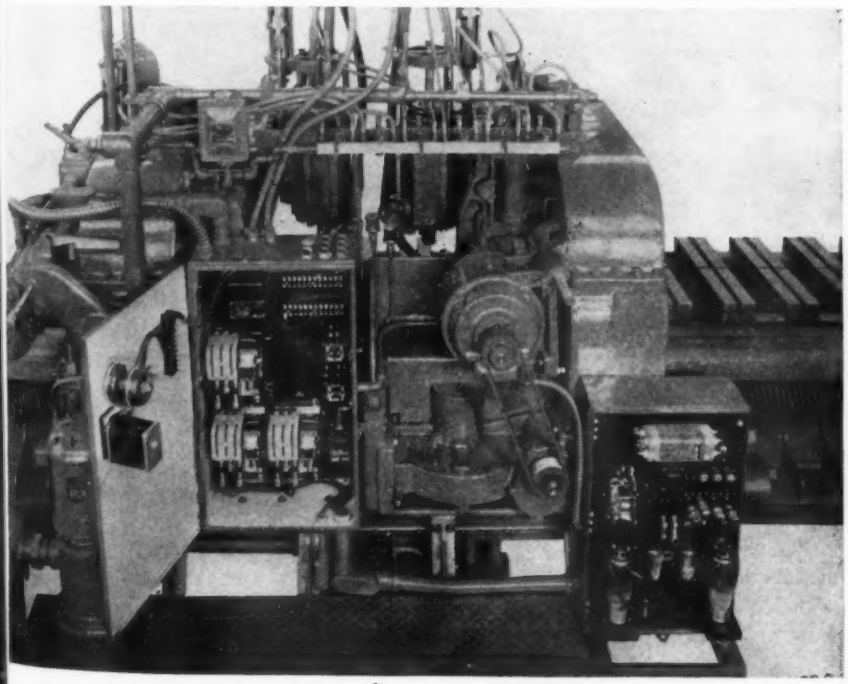


Fig. 3—Diagram shows Thymotrol rectifiers connected to direct-current shunt motor

Fig. 4—Standard Thymotrol panel (lower right of photo) mounted on machine for milling airplane spars controls direct-current feed motor. Alternating-current magnetic control (left center) regulates the numerous other operations of motors on the machine



erating range. This equipment provides this feature so that the motor will be accelerated smoothly up to the speed called for by the setting of a potentiometer rheostat. The motor is always started under full-field conditions regardless of whether the potentiometer is set for operation below base speed by armature-voltage control or above base speed in the field-weakened higher-speed operating range.

Quick stopping of the motor is provided by conventional dynamic breaking. When the stop button is pressed, the power is disconnected and a resistor connected across the armature.

Speed Range Obtainable

Speed range obtainable with this equipment is largely a function of size and type of motor. Theoretically, it extends from nearly zero up to the maximum for which the motor is designed to operate by field weakening. Practical speed-range limits are largely determined by heating and stability of the motor. Tests show that the motors can be operated over a range up to 20 : 1 below base speed by armature control, on an intermittent basis, without exceeding a dangerous temperature rise, and as high by field control as the motor is designed to operate. Much, however, depends on load and duty cycle.

For a given speed setting, control can be adjusted to hold the speed within a range of approximately 2% variation from no load to full load when operating below the basic motor speed. When operating in the field-weakened range, as load increases speed will decrease as much as 10%, depending on drive rating.

For applications requiring a more precise speed regulation than that obtained with standard equipment, output voltage of a tachometer-generator can be used to obtain a speed regulation on the order of plus or minus 0.5% from no load to full load. This arrangement provides exceptionally close regulation regardless of line-voltage variation. Certain testing equipment often demands such close regulation.

One important consideration with any electronic equipment is the question of what would happen if one or

(*Continued on page* 150)

THE OLD CHIEF

Nerves and Pressure

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies just beneath the maze that is woven of power plant costs and the wavy lines on paper disks

". . . climb hot ladders to check traps and valves."

▶ BY DISCREET INQUIRY, eavesdropping and adroit questioning of innocent witnesses, I have discovered that a large number of well-meaning persons, who live on the outskirts of our calling, regard operating engineers, as a whole, as unsocial, boorish and bad-tempered men, who take an unholy delight in snickering at the ignorance of ordinary human beings.

I asked the Old Chief whether he thought the charges unfair. He pointed out that he could hardly be called an unprejudiced bystander. But in regard to the charges of unsociability and boorishness, he thought that this impression probably results from engineers being forced at least to assume these manners in order to prevent a power house from becoming the mecca and haven of all light and heavy loafers in the plant, white collar and black collar alike. In regard to the charge of bad temper, he claimed that considering the responsibility and pressure under which most of us are working, a very small number of engineers become jumpy. Those that do have the misfortune to develop nerves are soon on the side lines with ill health.

A Vacancy

Continuing further on this subject, the Old Chief asked if I remembered Benjamin Ruth, who was one of the relief engineers when I started at the old plant. I well remembered the teapot tempest that centered about him.

The Old Chief's right-hand man, known as the powerhouse foreman, had been promoted to the position of works manager, and the conjectures among young and old as to who would step into his shoes were by no means unanimous. The favorite selection of the railbirds was some unknown entry who would be imported to win the race. Next on the form sheet was a round-faced day-shift charge hand, named Rolly, who had run the job on occasions and was credited with knowing the track; Burton, the maintenance foreman, was listed as conditioned and ready; a well-educated young man on the night shift was regarded as not to be disregarded.

The result was known one morning when the Chief emerged from his office with, of all people, Ben Ruth, a 100-to-1 field entry. Next to the defeat of Man-O-War by Upset, this was the big surprise of the year.

He Left Evidence

Years after, when I had gained the Old Chief's confidence, I asked him why he had picked Ben Ruth. He stated that in a nutshell it was because Ben never left the plant without leaving behind him some useful evidence that he had been employed that day or night, and had done something more than he had been asked to do, whether it was the finer adjustment of an automatic oiler or the cleaning of a drip pocket.

In all his work there was the hallmark of workmanship and permanency. He was not too lazy to climb hot ladders to check out-of-the-way traps and valves. When he discovered that lockers and closets had become receptacles for flotsam and jetsam, he cleaned them up without any attempt to pass the buck or make a fuss. When he was asked to inspect anything his reports were complete, accurate and concise; his data sheets were neat, extended and full of interesting notes under the heading of "Remarks."

Here truly was the man for the job: a man that would not let the plant fall down about his ears, a man that would secure the best results from every piece of equipment.

Intolerance Complex

Sad to relate, it did not turn out that way. Ben, for some reason or other, just could not convey to others what he wanted done. He was forever tied up with jobs all over the plant, to the neglect of his more important duties. His attitude toward the engineers was one of distrust, complaint and suspicion. Soon he was on edge with everyone. None of the men did anything extra because they knew that unless Ben thought of it first, it was no good. He substituted arguments and feuds for instruction and tolerance. Soon he worried himself into ill health and left for quieter fields.

As the Old Chief finished his story, he fixed me with a baneful look and added, "I have since found that I get on well with men of low intelligence."

Practical suggestions for creating emergency capacity . . . substitutes for hard-to-get parts and materials . . . cures for overloads, breakdowns . . . ways to build up short-handed staffs. Share your ideas! Send in your rough notes and photos or sketches. Payment at regular rates

WARTIME POWER CLINIC

Seat Ring Wrench

THE VERY INTERESTING piping maintenance section (POWER, December, 1942, page 65) showed a wrench, Fig. 1, for removing seat rings from small valves. If this wrench had a tailpiece extended down through the seat ring to guide and seat it, removal of the ring would be much simplified.

Since manufacturers don't seem to make wrenches with tailpieces, I had a set made for valves up to 1 in., and they worked perfectly. Fig. 2 shows two of them, that on the right with a ring seat in place on the tailpiece.

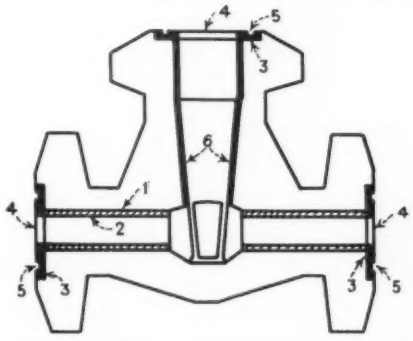
While on this subject of piping, I wonder why such a convenient and economical connection as the ordinary union is not more widely used around industrial plants. Unions mean fewer joints to cut and hence fewer potential leaks.

Portland, Me. R S PINKHAM

Alloy Relining Renews Costly Valves

Data and illustrations from a study submitted to the James F Lincoln Arc Welding Foundation by Everette E Kerns, Mechanical Engineer, Standard Oil Co (Ohio), Cleveland, in its recent $200,000 Industrial Progress Award Program for reports on advances made by the applications of arc welding in design, fabrication, construction and maintenance.

The 2½-year welding study, in which 408 awards were made, indicated a possible annual saving by arc welding of 1825 million dollars, including 7 million tons of steel, valued at 271 million dollars and 153 million man-hours of labor.



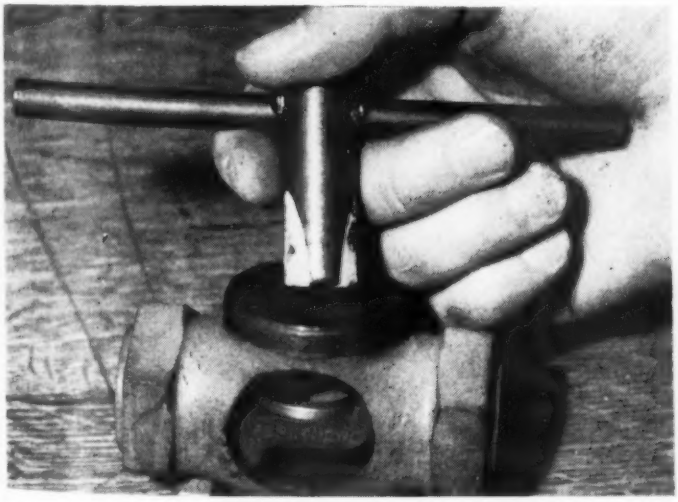
Steps in relining a 4-in. forged-steel gate valve: 1. Bore run-of-way to true surface. 2. Press-fit sleeves of 11/13% chrome or 18-8 chrome-nickel are flush with flange faces and stop ⅛ in. from seat rings. 3. Machine flange face to receive weld metal. 4. Deposit 25-20 chrome-nickel weld metal. Then machine flange faces to original dimensions. 5. Machine ring-joint groove in deposited weld metal. 6. Deposit 3/32-in. layer of weld metal—not machined

THIS METHOD OF VALVE REPAIR was developed to meet the extremely severe operating conditions of the oil refining industry. These include corrosion, temperatures up to 1000 F and pressures up to 1500 psi. Long ago increasingly severe service forced the refiner first from cast-iron valves to steel, and then to steel valves trimmed with stainless material—for example, gate valves with stainless-steel trim on gate, seats and stem.

Finally he made these parts of solid stainless steel to resist corrosion and erosion. There remained the problem of corrosion on flange faces and corrosion and erosion in the valve body, including run-of-way and bonnet section. Here electric welding now saves a lot of money.

Inspection departments have established definite minimum thickness limits for the metal of valve bodies for various services. If the material thins down to these limits the inspector condemns the valve.

(Continued on page 98)



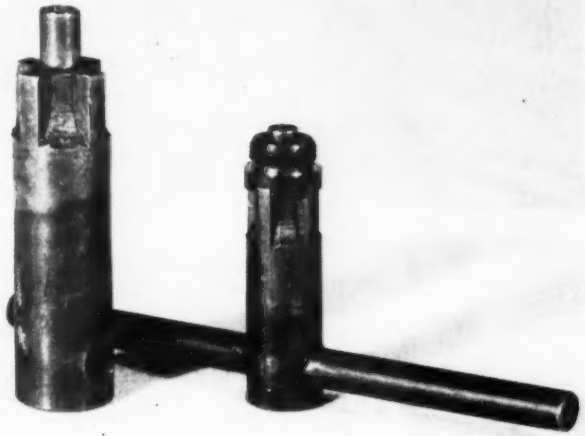
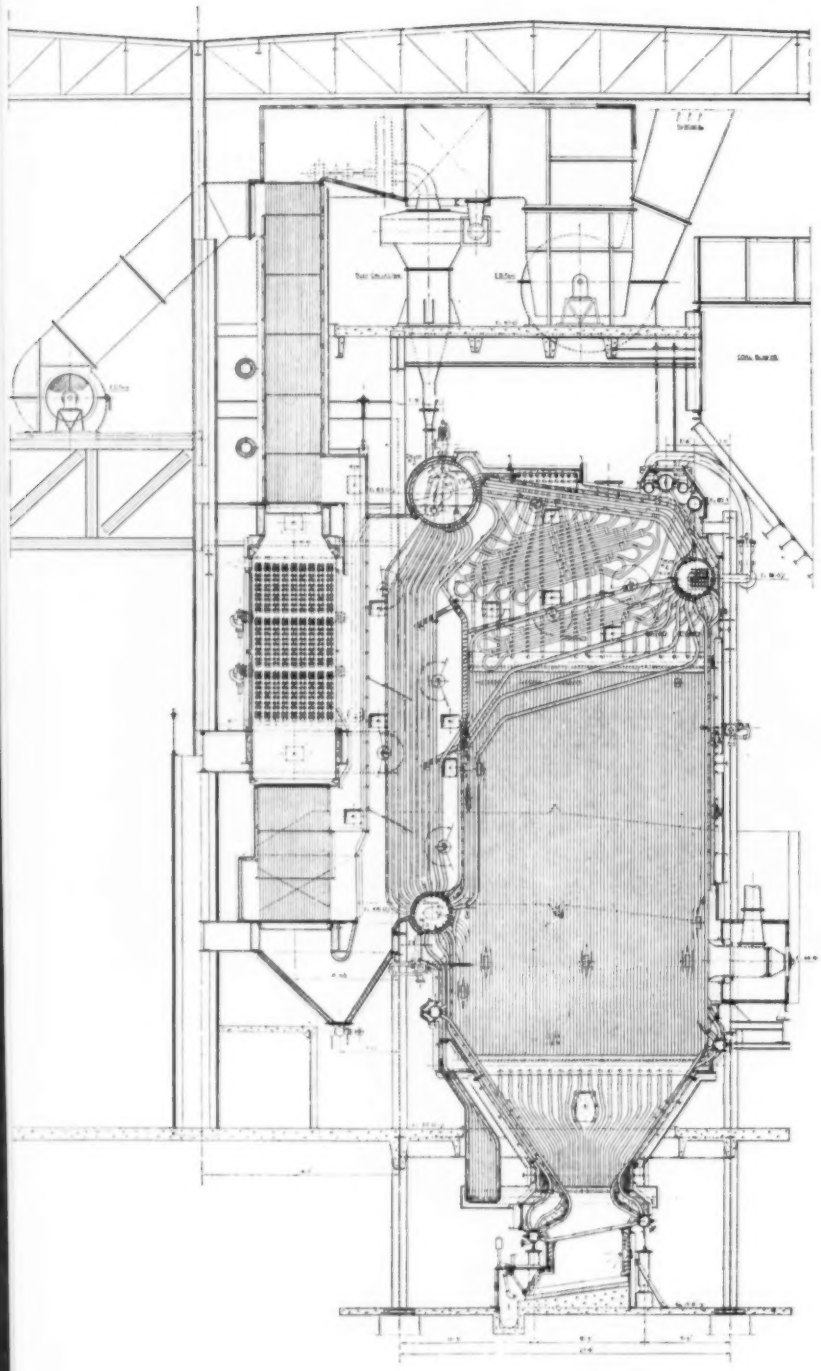


Fig. 1—Seat ring wrench as pictured in December, 1942, POWER. Fig. 2—Added tailpiece, in this improved form, guides wrench and simplifies seat-ring removal. Author has made such wrenches for valves up to 1-in. pipe size.

RILEY



check

These operating results against guarantees at this 375,000 lbs./hr. Riley central station installation.

Guarantees Actual Results

	Guarantees	Actual Results
Steam Pressure	862 lbs.	864 lbs.
Steam Temperature	900° F	902° F
Gas Temp. Leaving Boiler	775° F	723.4° F
Gas Temp. Leaving Economizer	470° F	445.8° F
Gas Temp. Leaving Air Heater	322° F	305° F
Air Temp. Leaving Air Heater	488° F	498° F
Draft Required Boiler Outlet	2.8 in.	2.2 in.
Draft Required Economizer Outlet	4.0 in.	3.7 in.
Draft Required Air Heater Outlet	6.9 in.	5.4 in.

LARGE ILLINOIS PUBLIC UTILITY

Steam Capacity—375,000 lbs./hr.

Steam Pressure—900 lbs.

Steam Temperature—900° F.

Efficiency 86.2% at 375,000 lbs./hr.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

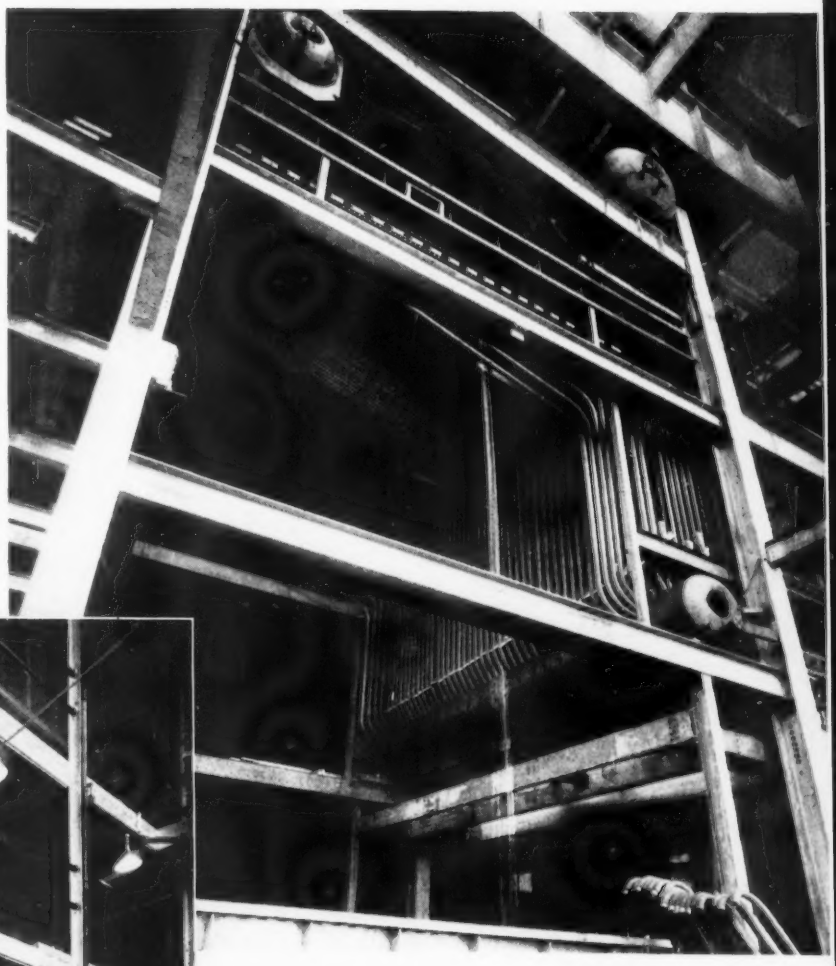
Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

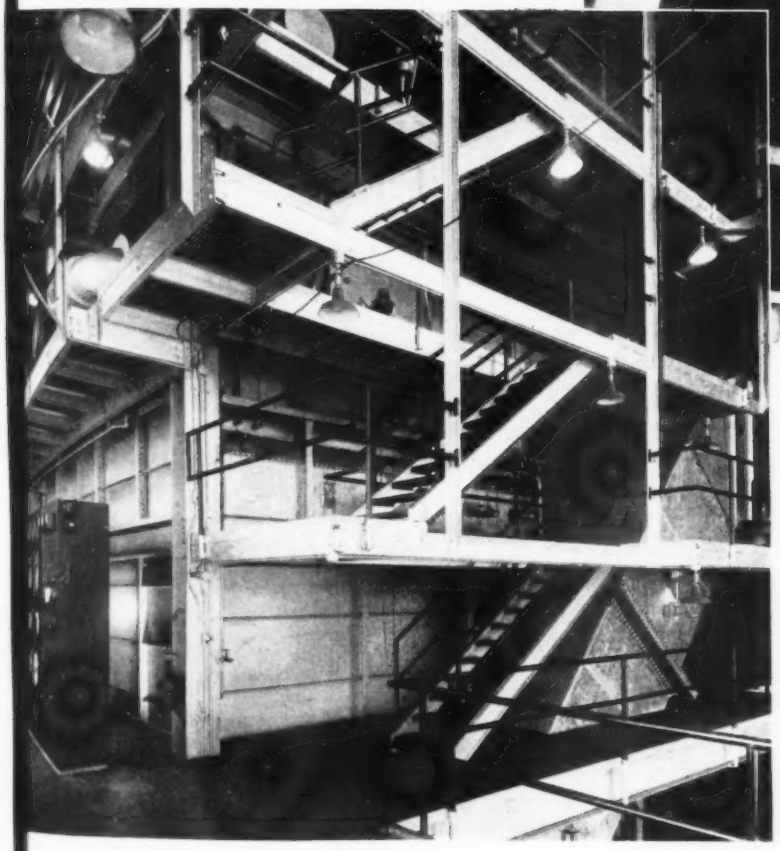
Results again exceed guarantees

Here is another example where the actual results of Riley Units exceeded guaranteed performance. Because Riley results so consistently exceed guaranteed performance both as to efficiency as well as capacity, purchasers of steam generating and fuel burning equipment have come to expect these plus values from Riley equipment and have found they can rely on Riley to fulfill their expectations.

On 23 recent tests conducted on Riley Units, actual efficiency exceeded guaranteed efficiency by an average of 1.405 points of efficiency, representing thousands of dollars additional fuel savings to Riley users.



Construction photograph during installation of Riley unit shown on accompanying page. Note excellent shape of furnace resulting from distinctive contour of tube bank.



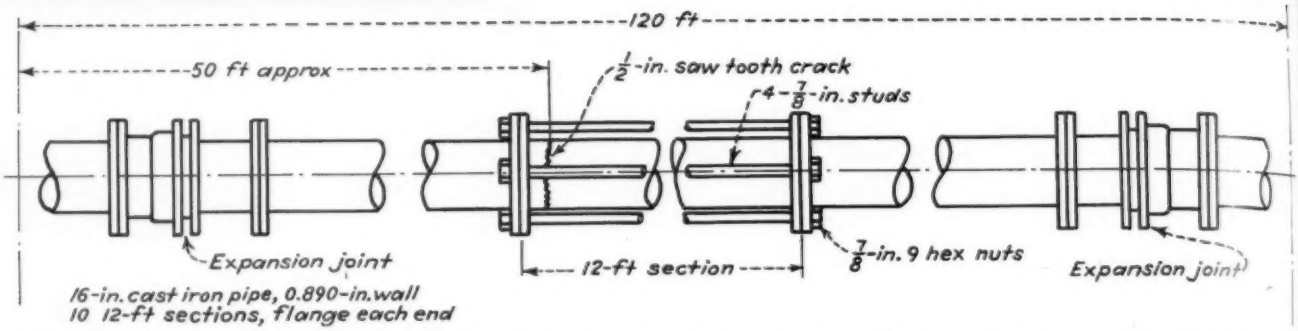
View of completed installation at one of the upper levels. This central station ordered this 375,000 lbs./hr. Riley Unit after having operated a similar 300,000 lbs./hr. Riley Unit for several years.

survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

OMPLETE STEAM GENERATING UNITS

OILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
CONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment



Four threaded ⅞-in. rods, about 12 ft long, held pieces of cracked cast-iron steam pipe together almost leak tight until operators could make permanent repair

(*Continued from page* 95)

Nowadays we restore such worn valves by welding. We take the valve out of service just before the metal thickness reaches the limit, and have the machinist take a light cut from the run-of-way to smooth the surface. He also recesses flange faces from the port out beyond the gasket groove.

Next, the welding department inserts a tube of stainless-steel material, either 11–13% chrome or 18–8 chrome-nickel, in each end of the run-of-way. This tube, pressed in, extends to within ⅛ in. of the back side of the seat and is flush with the machined faces of the flange at the outer end.

The welder then arc welds the outer end of the tube to the valve body with stainless-steel electrodes of 25–20 chrome-nickel. He carries this alloy deposit over the prepared recess in the flange face, building it up to a level some ⅛ in. higher than the original face of the flange. The face is then machined and grooved to its original dimensions.

Because the bonnet section is rough, it is not practicable to line it with any kind of sheet material, so the welder deposits stainless steel over the entire surface, all the way from the top of the bonnet flange to the top of the seat. This deposit also is about $\frac{3}{32}$ in. thick, and of the same 25–20 chrome-nickel. Worn seats and gates are salvaged by machining lightly, building up with alloy deposit and then remachining.

Long Bolts Hold Cracked Pipe Steam Tight

WHEN A BIG LEAK developed recently in a 16-in. cast-iron main carrying low-pressure steam to heat five buildings at General Electric's Schenectady works, long studs held the cracked pipe section together and thus maintained steam supply until new piping could be installed. This was a low-pressure job.

For this emergency repair, managed by J E Schoenborn, general foreman of the steam fitting crew, four ⅞-in. rods over 12 ft long were threaded at both ends and used as studs to tie the flanges at one end of the 12-ft section to those at the other end, as shown in the sketch.

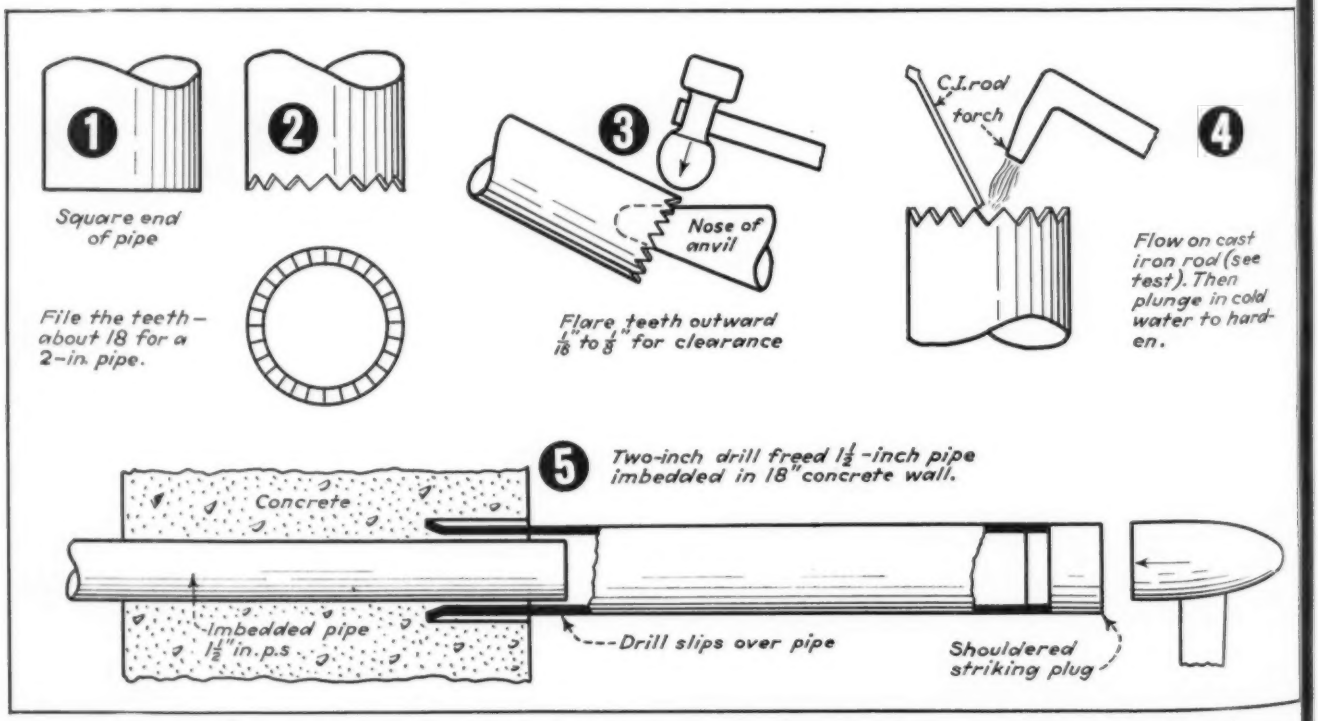
While setting the nuts up tight, the steam fitter hammered lightly along the jagged crack around the pipe. This mated the broken ends so perfectly that leakage was negligible.

Pipe Drill Will Hold an Edge

Because star drills are getting scarce, here's a method I have used for years for drilling through brick and concrete.

First, select a piece of pipe the right size for the hole desired. Square the end, then file the teeth, using a square

(*Continued on page* 156)


1
Square end of pipe
2
File the teeth—about 18 for a 2-in. pipe.
3
Nose of anvil
Flare teeth outward 1/16" to 1/8" for clearance
C.I. rod
torch
4
Flow on cast iron rod (see text). Then plunge in cold water to harden.
5
Two-inch drill freed 1½-inch pipe imbedded in 18" concrete wall.
Concrete
Imbedded pipe 1½" in. p.s.
Drill slips over pipe
Shouldered striking plug

Concrete drill, made from pipe, is effective tool because teeth are flared for clearance, carbonized and hardened

Textiles—in War as in Peace

World's oldest industry performs modern miracles

WITH ever quickening tempo the friendly hum of the spinning wheel has echoed down the centuries—symbol of a mighty industry.

Its hum is heard today above the din of war.

Capt. Rickenbacker heard it as the lives of his party depended upon a thickness of rubberized fabric.

The hard-pressed soldier on a far-off Pacific isle hears it when he sees fresh supplies and ammunition descending from the sky via friendly parachute.

Adolf Schickelgruber hears it when winter joins forces with the enemies of his ill-clad armies and hastens the day of his defeat.

Yes, man is dependent upon textiles from the cradle to the grave—in peace and in war.

In peace man demands comfort and beauty. In war he must have comfort and protection. The textile industry is coming up to these expectations.

It is developing hundreds of special fabrics for special purposes. It has created clothing for wear, miles high in the stratosphere, and fathoms deep under the sea, clothing to meet the daytime heat of the desert and the bitter cold of its nights, clothing for the tropics and the Arctic, the swamps and mountains—for every climate and every condition.

Modern scientific warfare has forced the development of textiles that were not even thought of a year or two ago: camouflage nets; strong, light, wind-resistant Nylon tentings for the Arctic; heavy Nylon rope for glider towing; parachutes and parachute shrouds; self-sealing gas tanks; panzer hangars; cartridge and powder bag cloths; helmet linings; gas masks; fuses; canvas tops; windshield fabrics and seat upholstery for jeeps, trucks and other motorized equipment; uniforms for all armed services and for nurses, WAACS, WAVES, SPARS and MCWRS. Then there are windbreakers, raincoats, ski-troop uniforms and other items two numerous to mention. The Star Spangled Banner itself is a textile.

The Quartermaster Corps alone has issued specifications for over 300 different fabrics! Add to this the requirements of the Navy, the Air Forces, the various Civilian Defenses, the Red Cross and Lend-Lease and the sum total of textiles required for military and allied uses is approximately 70% of the total produced before the war to meet civilian requirements!

How the textile industry has been able to meet this unprecedented war demand, superimposed upon the industrial and essential civilian needs, is an inspiring story.

First, it stepped up its production to an all-time high. *Textile World's* index of textile-mill activity records three successive records for 1940, 1941 and 1942, the period covering the defense program and the first year of the war. This index for 1942 stood at twice that of an assumed "normal" year. It is noteworthy that this was accomplished mainly with existing equipment.

Second, the textile industry did a job of plant-conversion which was a masterpiece of intra-industry cooperation and idea-sharing.

Third, its technicians developed new and superior fabrics and finishes. Its engineers and production men increased the speed and the efficiency of the entire production machine.

How well all this was done becomes evident when we consider the obstacles to be overcome. Imports of critical fibres have been cut off. There is a shortage of certain chemicals and dyes. There is a high rate of turn-over in manpower and a shortage in experienced labor. It is increasingly difficult to secure machines and repair-parts—just to mention a few of the major problems.

But the textile industry delivered. It has built up an adequate reserve for our rapidly expanding armed services. It is helping to supply the armies of our allies. It is providing for our civilian population . . . all without giving the war leaders a single moment of serious worry.

Major General Edmund B. Gregory, Quartermaster

This is the ninth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

General of the United States, in special statements prepared for *Textile World*, and in addresses before textile groups, has stated that the cooperation of the textile industry has been outstanding and that the industry has kept ahead of schedule on all the major types of fabrics required.

General Gregory recently pointed out that of the approximately 234,000,000 yards of combed twill produced in this country in 1942, the Army took about 87%, the Navy 10%, leaving 3% for non-military purposes.

Col. Robert T. Stevens, of the Quartermaster Corps, in a recent address, referred to the output of duck. Production of that vital military fabric was twice doubled in six months, between January and July 1942, he said, and an annual capacity of 600,000,000 yards of all types of duck was made available. "The current rate of production of cotton duck is five times normal," said Col. Stevens, "and 38% comes from converted carpet, plush and upholstery mills. Based upon known requirements, production in this field is fully adequate".

"Fully adequate" is high praise when it refers to duck production. At the outbreak of the war it looked as if there was no possible chance of meeting requirements, at least during the first year. Nor would there have been if other types of mills had not shifted to making this fabric, and if experienced duck manufacturers had not gone "all-out" in teaching the newcomers, potential post-war competitors, everything they knew about the manufacture of duck. American industry offers many such examples of unselfish cooperation.

Another outstanding accomplishment, made necessary by the interruption of burlap imports, was the conversion of looms producing peacetime fabrics to the production of bag fabrics. The tremendous demand for sandbags, camouflage cloth, food, agricultural and other bagging, caused a conversion order to be issued for the purpose of raising the annual production rate of osnaburg from 263,500,000 yards to 660,000,000 yards, and bag sheeting from a rate of 488,000,000 yards to 855,000,000 yards. The result of this order, and of the military schedules already in effect, was to put the cotton weaving industry about 88% into war, essential industrial, and essential civilian production.

Plant conversion went on with feverish speed. Carpet looms were swung to blankets and duck; the lace industry turned to mosquito netting and insect netting of which it produced millions of yards. The flat-knitting industry with its tricot machines also is engaged in the manufacture of mosquito netting. The sewing thread industry was converted to the production of combed yarns. What once was the silk industry is now doing a tremendous amount of war work. Those mills which had equipped themselves for throwing Nylon yarns for hosiery are now throwing the Nylon for parachutes. That section of the silk industry that was equipped for weaving rayon fabrics is producing fabrics of high-tenacity rayon for flare chutes, cargo chutes and delivery chutes. Many silk and rayon looms that formerly wove clothing materials are now weaving parachute fabrics.

Today practically all Nylon is used for military purposes and the bulk of high-tenacity rayon goes into military fabrics.

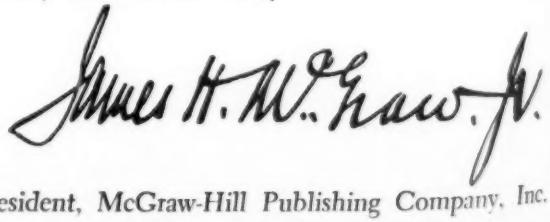
Above and beyond all the new developments is the gigantic job of producing millions of yards of standard fabrics of many colors and weaves. To produce all the uniform fabrics and blankets is in itself quite a job. The woolen and worsted industry has been doing it magnificently. Tent fabrics and summer fabrics produced by the cotton industry are no less a formidable assignment. I could point to myriad other jobs no less impressive.

The production man can indeed take pride in this record and behind the production man, the textile technician has been working tirelessly. Mildewproofing and waterproofing, so vital in a world at war, are in a new stage of effectiveness. A new process for waterproofing fabrics employs vinyl acetal plastic in place of precious rubber. Textiles that glow in the dark have been perfected for black-outs and other applications. American genius is solving problems many of which seemed insurmountable. Silk, for example, was something the Japanese thought we could never duplicate. A new synthetic textile filament that weighs but one eighth of the finest silk filament threatens to put the Japanese silkworm out of business after the war so far as we are concerned. The post-war possibilities of this development challenge the imagination.

Nor has the primary textile industry been alone in its contribution to the war. The textile machinery industry has been converted almost entirely to war work, save for a few facilities required to relieve extreme bottlenecks and supply essential maintenance and repair-parts.

Similarly, some textile mills, particularly hosiery mills hard hit by the silk and Nylon cut-off, are utilizing their space and skilled staffs to produce parts for war equipment.

The immediate significance of all this is its importance in the winning of the war. There is, however, a post-war implication which is important to the future of America. A mass production textile industry will serve civilians after the war more effectively than ever before, and will put new standards within the reach of millions. A long step has been taken toward that completely synthetic textile industry which some observers see in the future. The tempo of such changes has been accelerated tremendously. The oldest industry in the world, now one of America's largest, is showing a youth and vigor that promise much for the future... nationally and internationally.



President, McGraw-Hill Publishing Company, Inc.

Helpful Hints That Insure Good Rotary-Pump Performance*

Darwin F Schaub, application engineer, Worthington Pump & Machinery Co, discusses the characteristics of rotary pumps and shows how rotor speed, viscosity of the liquid pumped and suction and discharge pressures affect capacity, power requirements and efficiency.

▶A ROTARY PUMP is suitable for practically all capacity and pressure conditions. It can handle not only low-viscosity liquids, such as gasoline and light fuel oils for bulk station and unloading service, but also more viscous liquids, including heavy fuel oils, molasses and cellulose compounds having viscosities as high as 500,000 SSU.

In addition to handling many kinds of liquids, a rotary pump has the smooth flow of a centrifugal pump and the positive-displacement and self-priming features of a reciprocating pump. Having positive displacement, it can operate with a high-suction lift and can free itself of entrained vapors. It is simple in construction: The pumping elements generally consist of a set of gears, screws, cam and piston or lobes.

Pump Characteristics

Fig. 4 gives a typical rating curve for a rotary pump, showing effects of pressure on capacity, hp input, efficiency and displacement, the latter being the theoretical volume that the pump will discharge at any given speed. It is a constant value, as shown in Fig. 4, for any size pump, varying directly with pump speed, and is not affected by pressure or viscosity.

Capacity is the actual amount of liquid discharged by the pump. The difference between displacement and capacity is usually called *slip*, and represents leakage of liquid between the pumping element and its casing. Fig. 3 shows at *A* and *B*, in exaggerated form, the clearance spaces in the pumping chamber where the greatest amount of slip occurs. In a double-helical-gear rotor, there is a small amount of slip at *C* where the rotors mesh, because the contact line of their teeth curves from the suction to the discharge of the pump. This slip between the teeth is desirable because it eliminates high pressure caused by liquid trapped between the rotors, as at *D*, Fig. 2. This sometimes happens in spur-gear pumps, especially when the rotors have a wide face. Provisions must be made to relieve this pressure or it may overload the bearings, cause noisy operation, or even spread the shafts sufficiently to cause the rotors to rub the casing and overload the driving unit.

When a pump operates against zero discharge pressure its slip will be zero; therefore, displacement and capacity are equal, as at *A*, Fig. 4. As discharge pressure of the pump increases its slip also increases, as indicated by the separation of the displacement and capacity lines. Slip increases directly as the net pressure developed by the pump, so that capacity output varies at a rate determined by pump clearances and viscosity of the liquid. Fig. 5, based on

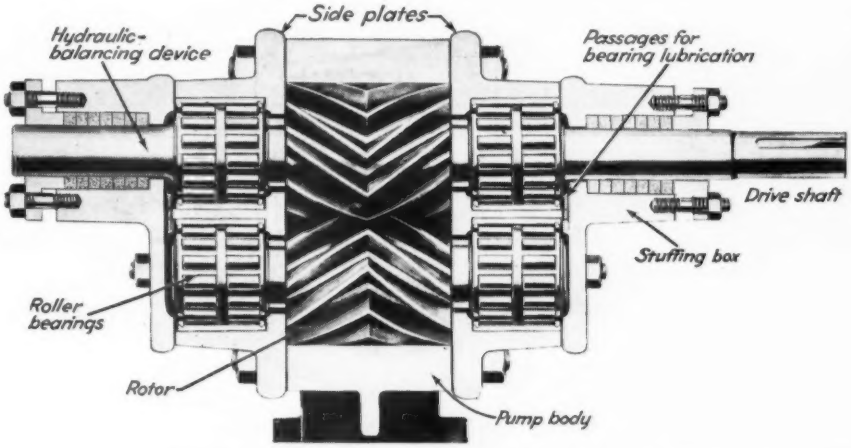


Fig. 1—Section through typical double helical gear rotary pump with roller bearings

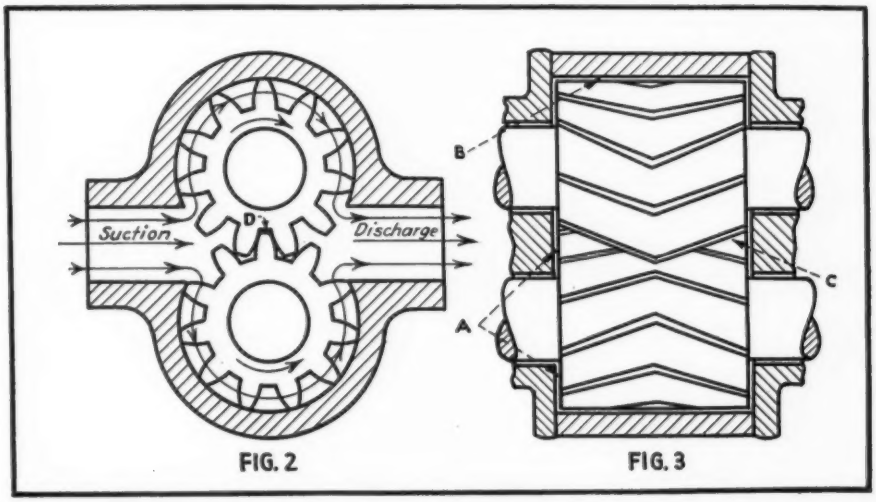
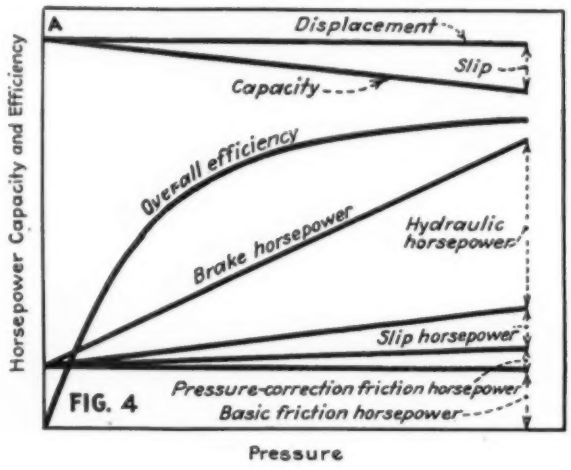
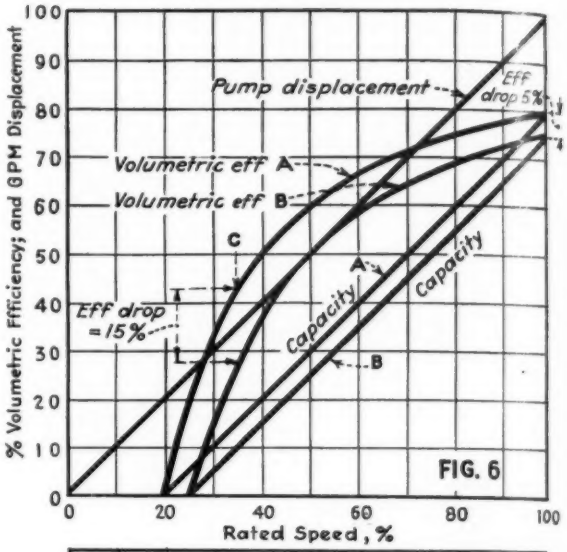
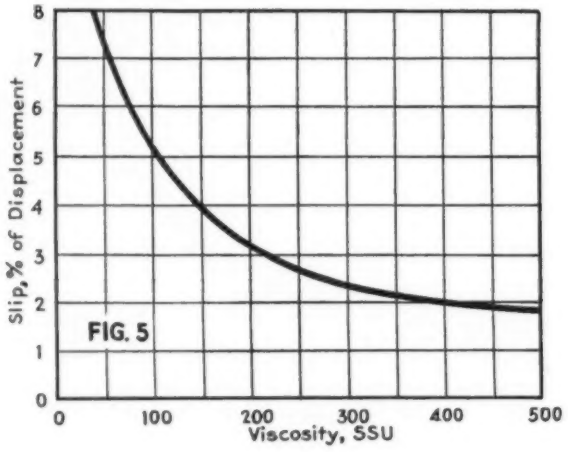


Fig. 2—Arrows on the continuous lines indicate flow through a gear rotary pump. Fig. 3—Leakage from discharge to suction of a gear rotary pump occurs at *A*, *B*, and *C*

*From a paper "Performance Characteristics and General Application of Rotary Pumps," submitted in the 1942 Prize Paper Contest sponsored by the Hydraulic Institute.







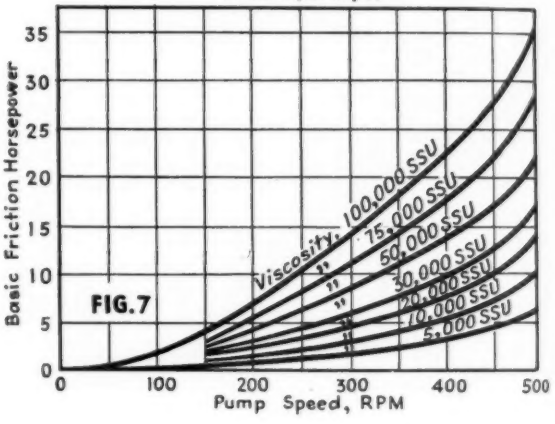


Fig. 4—Rotary-pump performance curves when speed and viscosity are constant. Fig. 5—Variation of slip with viscosity, at normal pump speed and 100 psi. Fig. 6—Effect of speed on rotary-pump capacity and volumetric efficiency. Fig. 7—Relation of pump speed and viscosity of the liquid to basic friction horsepower; note the rapid increase in horsepower as speed and viscosity increase.

normal pump speed and 100 psi, shows that the viscosity of the liquid has a marked effect on amount of slip that occurs in the pump.

Operate rotary pumps at full-rated speed when handling low-viscosity liquids. Fig. 6 shows how speed affects capacity and volumetric efficiency of a pump having a displacement of 100 gpm at 100% rated speed. At this speed the pump delivers 80 gpm against full-rated pressure and has therefore a volumetric efficiency of 80%. Since slip does not vary with speed, the capacity curve *A* is a straight line running parallel to the displacement line. If the pump speed is reduced to 20% of rated value, capacity becomes zero, because slip at this speed and pressure condition equals pump displacement. Therefore, if it can be avoided, do not operate a rotary pump just above the critical speed where the slip is equal to the displacement.

For example, assume that the pump is selected to deliver 15 gpm, which would require operating at 35% of rated speed. At this speed, volumetric efficiency is 43%, point *C*, which means that at least 57% of the power delivered to the pump is lost in slippage. Although the pump delivers 15 gpm only, 35 gpm must be pumped because 20 gpm discharged against full pressure slips past the rotors. When such a large proportion of the liquid pumped slips back into the suction, its temperature increases, because of the work done on the liquid, and may reduce viscosity to a point where increased slip reduces pump capacity to zero.

Pumping ability of a rotary pump depends on maintaining close-running clearances between pumping elements and casing. Generally, when a pump has been in service for a long time its running clearances increase because of wear, which, in turn, increases slip and reduces pump capacity. Assume that wear has caused a drop of 5% in volumetric efficiency at rated speed, represented by curve *B* in Fig. 6. At a speed of 35%, volumetric efficiency drops approximately 15% as indicated and, at 25% speed, the *B* volumetric-efficiency and capacity curves meet, showing that the pump capacity has become zero.

Suction Lift

Just as there is a minimum speed limit for a rotary pump when handling low-viscosity liquids so is there also a maximum limit for high-viscosity liquids to prevent a dropping off in pump capacity. As the pumping element displaces liquid from the suction chamber, a differential pressure produced between pump suction and source of liquid supply causes the liquid to flow into the pump.

If the pump operates at too high a speed, the differential pressure may not be sufficient to keep the pump full of liquid. When this happens some of the liquid vaporizes and causes the pump to

lose capacity and become noisy. This is particularly true with high-viscosity liquids, because the higher the viscosity of a liquid the greater its resistance to flow and the greater the suction differential pressure required to keep the pump full of liquid.

Horsepower

The total power that an electric motor, turbine or engine has to develop to make a pump deliver the required capacity against a specified head, is the *brake horsepower input* to the pump. The relation of brake horsepower to pressure at constant speed is a straight line, Fig. 4. If tests show that the brake horsepower line tends to curve upward at higher pressures, it is an indication that the pump rotors are rubbing against the casing because of shaft deflection. As shown in Fig. 4, brake horsepower includes the *hydraulic,* or *water horsepower, slip horsepower* and *friction horsepower.*

Hydraulic horsepower is the theoretical power required to raise a quantity of liquid to a definite height in a given time. *Slip horsepower* brings the liquid that slips past the pumping element up to discharge pressure. This power represents a loss and if the pump is not properly designed and maintained may reach serious proportions, particularly when the pump handles low-viscosity liquids.

Friction horsepower is the power required to overcome all mechanical and fluid losses in the pump. For convenience it can be divided into basic-friction horsepower, (the required power at zero discharge pressure) and pressure-correction friction horsepower (the power necessary to overcome added friction in bearings and between the rotors caused by operating pressure). Basic friction horsepower does not change with pressure, but it does with a change in speed or viscosity, with a very sharp rate of increase at higher speeds and viscosities, Fig. 7.

Efficiency

Fig. 8, 9 and 10 show effects of viscosity and speed on maximum efficiency. In general, maximum over-all efficiency moves toward the lower speed as viscosity increases. For example, in Fig. 8, viscosity is 100 SSU and a maximum efficiency of 80% occurs at 775 rpm. In Fig. 9, using 1000-SSU viscosity a maximum efficiency of 80% occurs at 450 rpm, and with a 50,000-SSU viscosity in Fig. 10, maximum efficiency of 67% is reached at 200 rpm.

Over-all rotary-pump efficiency curves drop off at low and high speeds and reach a maximum at some intermediate speed. This is because over-all efficiency is the product of mechanical and volumetric efficiency, both of which influence the over-all results. At low speeds, particularly with low-viscosity liquids, volumetric efficiency decreases, as discussed under speed and slip, and accounts for the over-all efficiency falling off at the lower speeds even though frictional losses are less. On the other hand, as pump speed increases, frictional losses become greater, thereby reducing mechanical efficiency. Maximum efficiency is reached at the point where reduction in mechanical efficiency equals the increase in volumetric efficiency. Beyond this, mechanical efficiency drops off at a greater rate, making the over-all efficiency decrease, as shown by the curves.

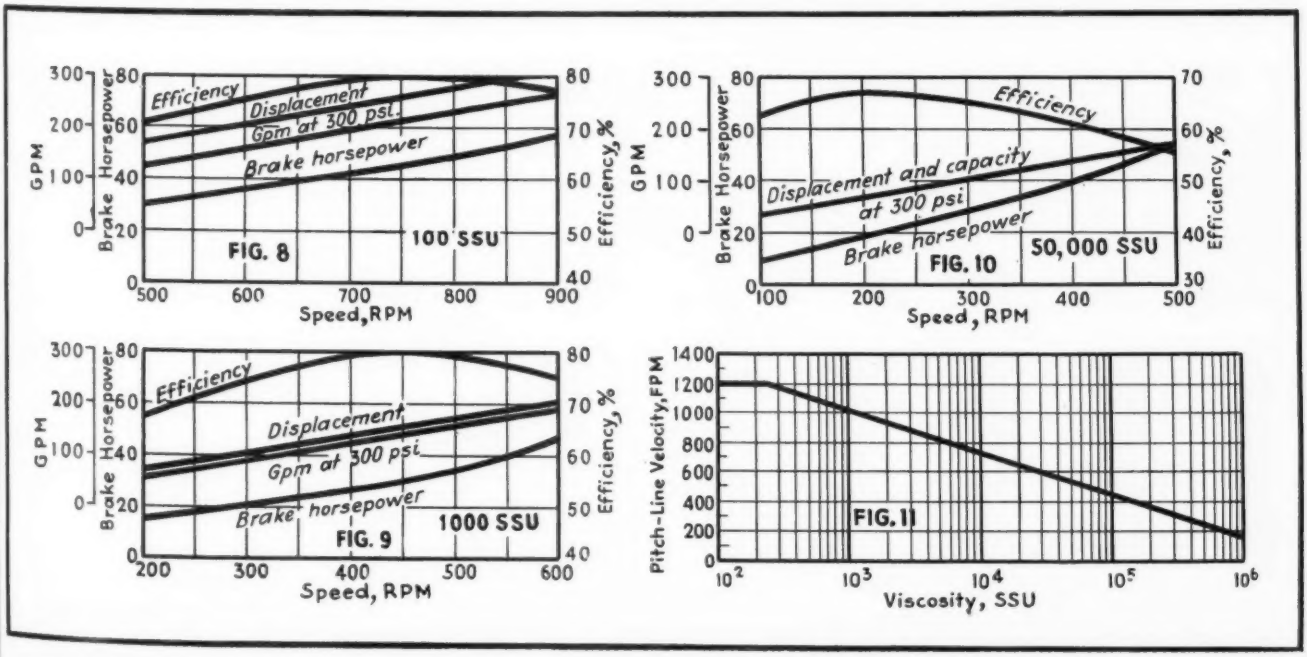
Pitch-Line Velocity

Heretofore pump speed has been referred to in terms of revolutions per minute, mainly because all driving equipment is rated that way. However, to understand more fully the characteristics of rotary pumps, particularly when various pump sizes are compared, all pump speeds should be reduced to *pitch-line velocity*, expressed in feet per minute, the velocity of the rotor tooth at the pitch diameter.

The importance of pitch-line velocity becomes self evident when considering the effect of viscosity on efficiency and horsepower. Since viscosity is the measurement of flow resistance, all values have to be reduced to the absolute fluid velocity in the pump, which in this case is the linear and not the rotational velocity of the pumping element, Fig. 2.

Fig. 11 gives the approximate maximum desirable pitch-line velocity of a particular design of pump rotor with viscosity. This does not mean that a pump cannot be operated beyond the values given, but it does indicate that pump performance in terms of efficiency and quietness of operation will become less desirable at velocity values in the region above the curve.

Fig. 8 to 10—Maximum efficiency shifts toward the lower speeds as viscosity increases as indicated by the efficiency curves. Fig. 11—The curve gives approximate pitch-line velocities of a particular design of rotary-pump rotor with viscosity



Consult the Manufacturer To Save Belt Dollars

R B Heller, Akron Belting Co, cites experience to prove that frequently belting problems have peculiarities which prevent applying conventional rules to their solution and that the belt manufacturer's advice may save you both money and trouble

This quarter-turn belt drive for short-centers uses one fixed pulley on each shaft to do the driving, and a loose pulley on each shaft for the return strand of the belt

▶ A BELT WHEN PROPERLY APPLIED is one of the most trouble-free of all power-transmission appliances, but when incorrectly applied almost anything can happen.

Not only must the belt have ample capacity for the drive, but it must also be suited to the peculiarities of the application. So, when ordering a belt be sure to give the belt manufacturer complete data on the drive. Here are two cases illustrating the importance of this suggestion.

A plant engineer asked for a quotation on an 8-in. heavy single-leather belt without telling anything about the service requirements. Correspondence revealed that the belt was to be used on a quarter-turn drive, as in the photo, where it would make four quarter turns for each revolution and that the center distances were only 4 ft, 7 in.

A peculiarity of this drive, particularly on short centers, is that twist in the belt tends to lift it off one side of the pulleys. The wider the belt and the shorter the center distance between pulleys, the more severe the twist and its effects in lifting the belt away from the pulleys. Conversely, a reduction in belt width automatically increases the belt contact with the pulleys, making it more effective in driving the load.

After some persuasion the customer was induced to install a 5-in. light double-leather belt instead of an 8-in. heavy single. Twist in this belt was far less severe than it would be in an 8-in. belt and the added thickness gave ample capacity to drive the load. At last report drive was operating satisfactorily.

Long Life From Right Belt

In another plant a machine's pulley had a 6-in. face and the operators installed a 6-in. belt. This was also a quarter-turn short-center drive like the photo. Two or three belts had short life, so the belt manufacturer was called in to make recommendations. He found that because of the short distance between driving and driven pulleys the twist prevented the belt from making proper contact with the pulleys. After considerable discussion the plant operator was persuaded to install a 2.5-in. light double-leather belt. That was nearly 25 years ago and the belt is still running.

These two experiences are by no means isolated. Doubtless every belting manufacturer at some time has had many such cases. They do, however, serve to emphasize that capable and experienced representatives of a belting company are frequently in a position to save belting users a lot of expense and at the same time improve the reliability of their power drives. This saving will not always be in the original price of the belt, but will show up in continuity of service, reduced maintenance costs, increased production, because power is correctly applied, and in uniformity of product because of steadier operation.

Good belting is not just so many strips of leather cemented together and merchandized in an ordinary way. Its application involves specialized engineering problems that the average mechanic cannot always work out intelligently. Machinery designers could also frequently profit by consulting a belting manufacturer. Having a knowledge of stresses, strains and vibration does not always qualify an engineer to specify belting; it requires experience in addition to engineering qualifications.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Packing Gives Good Service When You Give It a Break

Here's why: Most pump packing troubles are not the fault of the packing but are caused by the condition of the pump, the kind of liquid handled and lack of care during installation and breaking-in

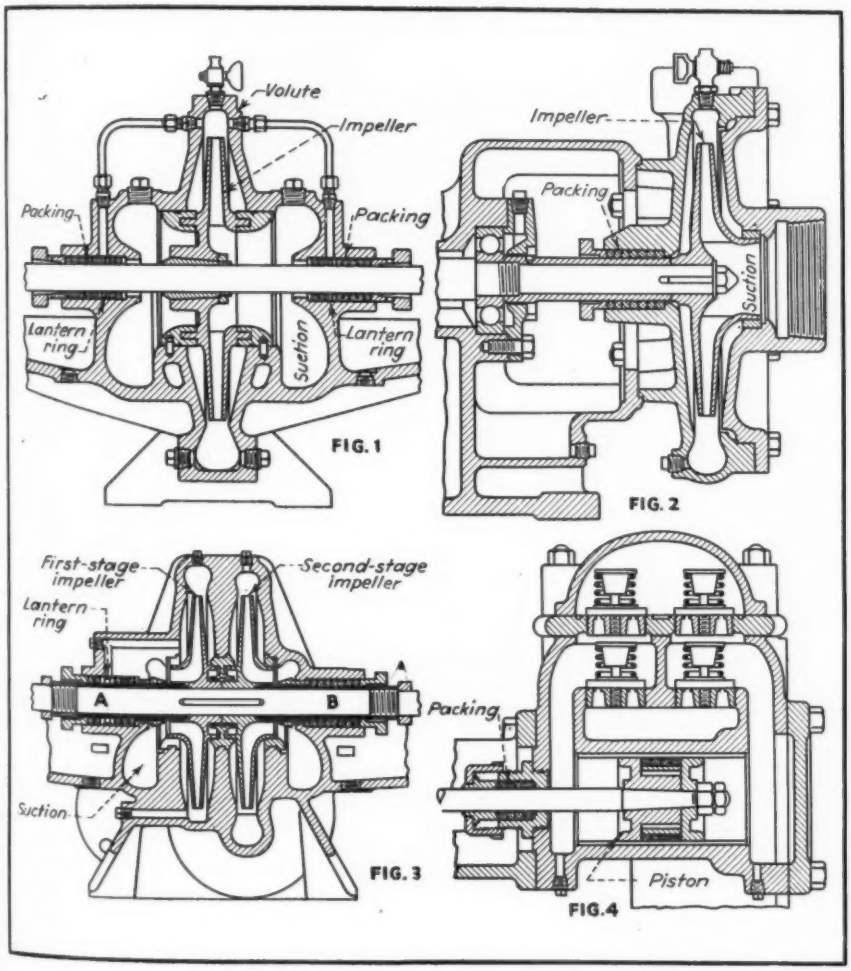


Fig. 1—In this pump both packings seal against low pressure. Fig. 2—Packing in this end-suction pump is subjected to discharge pressure. Fig. 3—Multistage pumps have one packing under low pressure and one under high pressure. Fig. 4—In a reciprocating pump, packing is exposed to low and high pressure.

PROBABLY EVERY power-plant engineer has pondered the problem of getting longer life from pump packing. The answer begins, at least in part, with the selection and installation of the pump. If the pump is not suited to its job, or is not properly installed and maintained, the best packing will not last long. Packing must be suited to its job, too, and correctly installed to give long, trouble-free service with minimum friction and shaft wear.

Assuming that all these conditions have been met, the best packing can be quickly ruined by trying to make it do something that it never was intended to accomplish.

Operating Conditions

Fig. 1 to 4 show some of the conditions under which packing operates in pumps. Packing in the single-suction centrifugal pump, Fig. 1, is subjected to suction pressure only, which is always low and below atmospheric if the pump operates against a suction lift. Under the latter condition, the chief job of packing is to keep air from leaking along the shaft into the pump and interfering with its operation. To assist in this, a lantern ring placed between the packing rings connects to the volute to apply liquids at discharge pressure on the impeller shaft. This liquid seal in the packing prevents air leakage along the shaft when only light pressure is applied to the packing by the gland. A small amount of liquid leaks along the shaft from the lantern ring in each direction to help lubricate the packing

and prevent the shaft overheating and burning it.

In the end-suction pump, Fig. 2, the shaft enters the casing on one side only and requires but one packing box. Practically full discharge pressure exists on the packing; therefore it must serve to keep leakage from the pump to a value just sufficient to help lubricate the packing and keep the shaft cool.

Two-stage centrifugal pumps, Fig. 3, have suction pressure on one packing, as at *A*, and first-stage discharge pressure on the other, as at *B*. On the suction, a lantern ring protects against air leakage into the pump. Packing on the opposite end of the pump is always under first-stage pressure, and does not require a lantern ring because liquid leaks out through the packing from the inside of pump. On this pump, then, packing on one end of the shaft serves to prevent air leaking in and, on the other, to prevent liquid leaking out. Packing on a reciprocating pump, Fig. 4, is subjected to suction pressure on suction stroke and to discharge pressure on discharge stroke.

Effects of the Liquid

The foregoing are a few of the conditions to which packings are subjected because of the type of pump. Add to these such factors as condition of pump, the way packing is applied, lubricating qualities of liquid pumped, its tendency to dissolve lubricant out of packing, its acidity and alkalinity, its pressure and temperature, its stability as it penetrates back into the packing, or whether liquid contains solids and their characteristics, and it is evident that pump packing may have a difficult and exacting job to perform.

If the liquid has lubricating properties these are beneficial to the packing and help to simplify its application. The liquid does not have to be a lubricant, but it does have to have properties that will form a film between shaft sleeve, or piston rod, and packing. Many liquids have this property. When the liquid has a tendency to dissolve the lubricant out of the packing, a good metallic packing is probably the answer to the problem.

The alkalinity or acidity of the liquid handled determines whether cotton, jute, flax or wool is the material suitable for packing, or whether the selection should be limited to asbestos or a metallic type. Pressure of liquid on packing, even though not as serious as temperature, should be kept as low as possible, but this is determined largely by the design of the pump and its service, as shown in Fig. 1 to 4.

Temperature of liquid limits the types of packing that can be used. Packing made of vegetable fiber should not be used much above 212 F. For higher temperatures use asbestos or metallic packing, or water-cool the stuffing box. The latter may permit using some of the vegetable-fiber packings.

Hot or volatile liquids may evaporate when they reach the lower pressure regions in the outer rings of packing. This complicates the packing problem because of lack of lubrication between packing and shaft sleeve, or piston rod. The answer to some of these problems involves using a mechanical or liquid seal, or water-cooling the stuffing box; in other cases, putting in the center of the packing assembly a lantern ring connected to an outside grease cup to lubricate and seal the packing.

The amount of solids in the liquid and their characteristics may be a serious problem. Packing, no matter how good, cannot give good service if abrasive materials from the pumped liquid work in between packing and shaft, and wear them. Another complication arises when crystals, sludge and other materials precipitate out of the liquid and build up between shaft and packing with an effect similar to drawing up the gland nuts too tight. In both cases, solution of the problem may call for backwashing through the packing with a suitable liquid or lubricant.

Leakage Necessary

A mistake frequently made in applying packing is trying to stop all leakage through it. When you must have a perfectly tight seal against leakage, probably the answer is not packing but some form of mechanical or liquid seal, or a combination of packing and seal. When you tighten packing until it is leakproof you pay a high price in increased packing costs, wear on shaft sleeves and piston rods, and increased power costs.

Packing Friction

Tests show that for a pump operating without leakage, packing friction on the shaft is about 30 times greater than for a pump with tolerable leakage. Another case demonstrates that loosening the stuffing-box packing increases the efficiency of a 4-in. centrifugal pump 4%. The packing remains tight enough to seal the suction chamber against air leakage. Removing all but one packing ring from the stuffing box and filling the space with a stiff grease raises the efficiency another 2%. The grease serves as a satisfactory seal against air leakage into the suction. These experiences give some idea of the power losses that may occur by making packing unnecessarily tight. These power losses are dissipated as heat in packing and shaft; therefore it is little wonder that overtightening causes packing to burn.

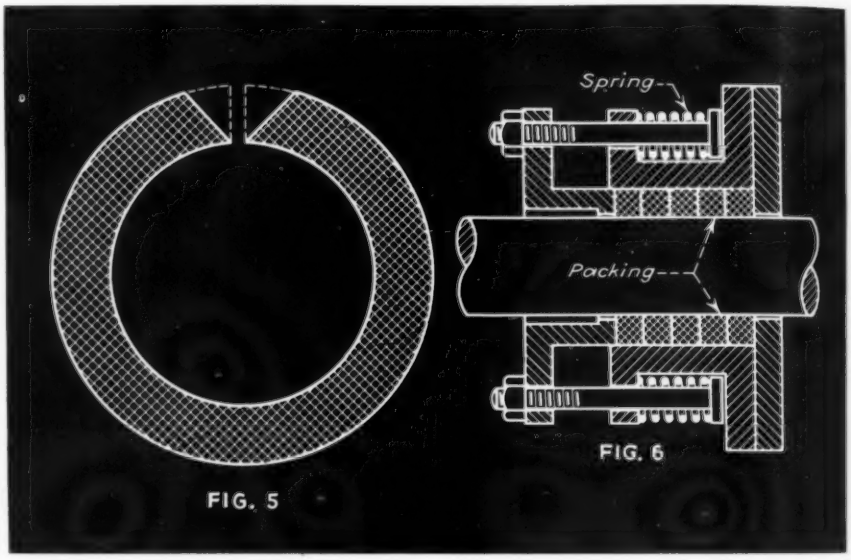


Fig. 5—Cut straight packing as indicated by dotted lines. Fig. 6—Springs on gland bolts help to maintain correct pressure on packing

Tests Made on Packing

Tests made to determine the action of packing under various conditions show that leakage is necessary to satisfactory operation. Most engineers know that with shaft or piston rod in good condition and with packing properly installed, gland nuts need be only finger tight to reduce leakage to a small amount, while to stop all leakage the packing must be held very tight and adjusted frequently.

When packing is tightened to be leakproof it is squeezed hard on the shaft until its fibers actually contact the metal. Even though the contact is well lubricated at first, the lubricant is soon squeezed out, and friction and temperature increase. The elevated temperature thins the lubricant in the packing so that it works out easily and it is not long before the packing requires tightening again to prevent leakage. Then the vicious circle starts all over again: increased friction, temperature, thinning out of lubricant in packing, and leakage. When packing has been compressed to its limit and cannot give up any more lubricant, its surface becomes so burned and hard that it scores the shaft.

Test and experience emphasize the necessity of care in the installation of packing. Before repacking a stuffing box be sure that all old packing is removed and all surfaces in the box are clean. Carefully fit the first packing ring so that it can be used as a template to cut the other rings. Whenever the type of packing permits, bevel the ring ends. If the ends of straight packing are cut square and then bent around the shaft, they tend to meet in a V, as indicated by the full lines, Fig. 5. This can be avoided by beveling the ends so that the outside of the ring is longer than the inside as indicated by dotted lines. This problem does not exist if packing is purchased in a coil with inside diameter approximately equal to shaft or piston-rod diameter.

If packing has a tendency to swell after installation, because of the action of the fluid, allowance should be made by cutting the rings a little short. Cut all rings of equal length so that they fit alike on shaft or rod. As each ring is put into the stuffing box be sure that it seats evenly against the preceding ring. When a lantern ring is used between packing rings, put the right amount of packing in front of the lantern ring. If this ring is not in the right place the sealing water cannot reach the shaft. This may cause overheating of the packing and the impeller shaft, shorten packing life, and permit air leakage into the pump.

Tests and experience both emphasize the need for carefully breaking-in packing. One plant finds that the life of packing can be practically doubled by this careful breaking-in: After putting in new packing set up the gland nuts finger-tight only and caliper the space between gland and pump to square gland with shaft or piston rod. Light pressure on the packing permits it to shift slightly to a good fit. After the pump has operated awhile, gradually tighten the gland nuts to reduce leakage to the desired amount.

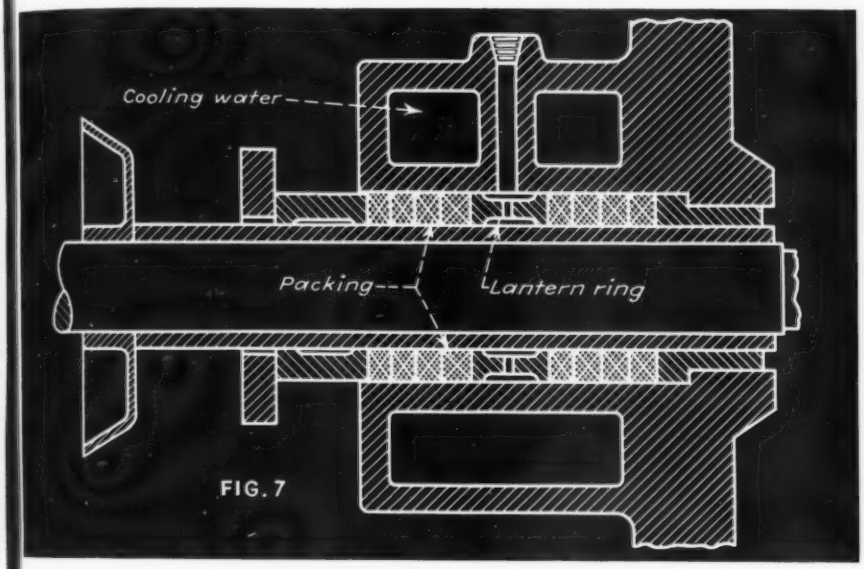


Fig. 7—When high-temperature liquids are pumped it may be necessary to water-cool the stuffing box to obtain satisfactory packing service

Tightening Gland Nuts

Tightening the gland nuts may be of importance in packing performance. Do not try to tighten them so that leakage is reduced to the allowable amount immediately. Tests show that immediately after taking up a small amount on the gland nuts, leakage actually increases and minimum leakage does not occur until 5 to 10 min. after the nuts are tightened.

Apparently, before the nuts are tightened, the braid interstices adjacent to the shaft are at least partly filled with leakage from the pump. After the nuts have been taken up a fraction of a turn, lubricant oozes from the packing into these interstices and forces the liquid out, temporarily increasing the leakage. By gradually tightening the packing a stable condition results in which leakage remains constant over a period, depending on the service.

If packing is tightened at once so that leakage has been reduced to the desired amount, it will probably be too tight and will in a short time reduce leakage below the safe minimum. Then because of local heating and expansion, the packing is further tightened and an excess of lubricant is forced out of it. This serves to shorten packing life even if no other harm occurs.

To insure more uniform loading on packing, spring-loaded glands, Fig. 6, are sometimes used. As the lubricant works out of the packing tension of the springs tends to compensate for it and keeps leakage at a predetermined value. Tests show that the springs do control leakage with fewer adjustments of the gland nuts than are required with bolts threaded into the stuffing box.

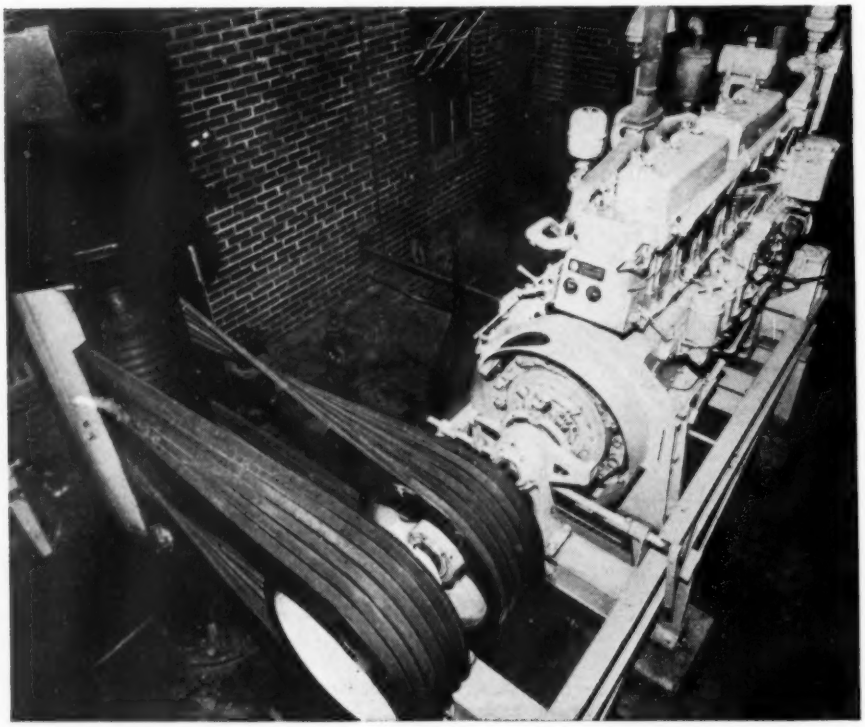
Pressure and Temperature

Both pressure and temperature affect packing life. However, increasing the pressure several times and permitting proper leakage does not have as serious consequences as reducing leakage below a safe minimum at reduced pressure. Hot water has several effects on packing life: At elevated temperatures its viscosity is reduced and, other things being equal, we can expect a higher leakage. However, this may not be evident on the outside because part of the water may flash into steam before it reaches the atmosphere.

Packing lubricants thin and escape more readily at elevated temperature; therefore packing requires more frequent tightening to control leakage. This tendency can be reduced by using packing saturated with lubricants that are not readily affected by temperature and that permit ample leakage. For high temperature, water-cooled stuffing boxes, Fig. 7, can be used to help keep the packing temperature within safe operating limits.

Never try to operate with leakless packing and hot water; attempts to do this have resulted in burning packing so hard in a few hours that it badly scored the shaft sleeve. Such troubles can only be eliminated by selecting proper packing, installing it correctly, and operating with sufficient leakage along the shaft to prevent burning the packing.

PRACTICAL AIDS TO OPERATION



V-Belts Applied on Short-Center Quarter Turn

CITY WATER for Alma, Mich., is obtained from a well by a 1500-gpm deep-well pump driven by a 125-hp motor and discharging against a 260-ft head. To insure 100% service from the pump it was decided to supplement the motor drive with a standby diesel engine to drive the pump in case power to the motor failed. To connect the horizontal-shaft diesel engine to the vertical shaft of the pump presented a problem that was solved by installing a quarter-turn 6-strand V-belt drive.

Space limitations prevented placing the engine far enough away from the pump to use a conventional quarter-turn drive. By the use of a tight and loose sheave on the pump and on an extension of the engine shaft, W E Reynolds, City Manager, was able to use a short-center drive like that in the photo. On the pump the tight and the loose sheaves are on the pump shaft between the motor and pump. The sheaves for the engine shaft are mounted in two bearings with one-half of a friction clutch. Sheave bearings and engine with the other half of the clutch are mounted on slide rails with two turnbuckles for adjusting their position to tighten or loosen the belts.

This arrangement made it possible to connect the 125-hp engine to the pump with a center distance of only 60 in. between their shafts. During normal operation the engine is pushed close enough to the pump to permit removing the belts and the motor drives the pump. In case the motor or power fails and will cause a protracted shutdown, the belts are easily placed on the sheaves for the diesel to drive the pump. The clutch between the sheaves and engine permits starting without load. When the engine drives the pump the motor rotor idles.

Shearing-Pin Mistake Wrecks Stoker

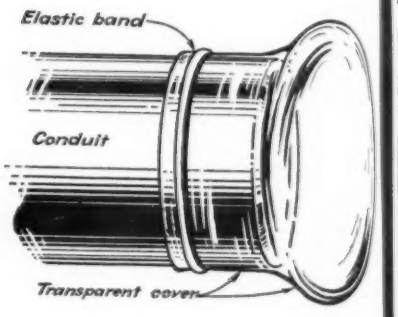
SHEARING PINS are used in many types of rotating and reciprocating power-plant machinery to safeguard against excessive overloads and damage to equipment. These pins are especially necessary where high-speed motors drive relatively slow-speed machinery through reduction gears or other positive-type drives. In such cases enormous loads may be put on the low-speed side of the drive before the high-speed motor stalls or opens its protective device.

Manufacturers of equipment requiring shearing pins usually supply them when requested. However, most everything, such as nails, soft steel rivets and pieces of other material have been made to serve as shearing pins. It is also easy in a machine shop to make shearing pins similar in size and shape of the original one. Be careful, however, not to use metal having several times the strength of the original pins. This has happened with disastrous results.

Failure of an operator to use proper shearing pins caused the wreck of a stoker. Having to replace a shearing pin, in this instance a ⅞x2-in. soft-steel rivet, on one of the rams he inadvertently picked up a case-hardened pin of the same dimensions from a chain drive. Shortly after the stoker started again it jammed with the result that its crank shaft was twisted and four of its bearings broken, requiring 24 hr to repair.

Moral: Make sure of your shear pins.

St. Louis, Mo. O C MILES



Protective Covers for Conduit and Cable Ends

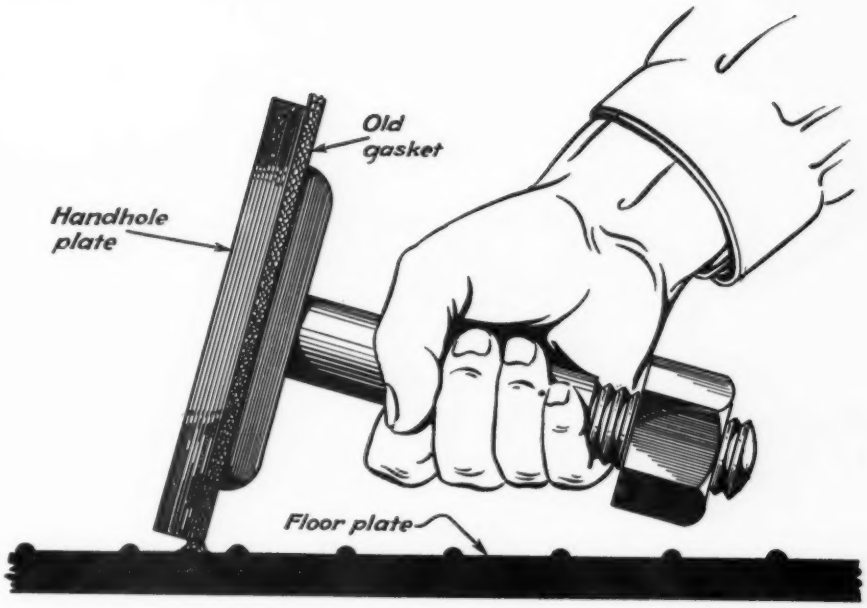
DURING INSTALLATION and repair work much trouble is caused by water getting into exposed cable ends, particularly in underground work. It is also desirable to cover open ends of conduit installed prior to running wire in them, as they are frequently filled with construction materials and sometimes water. I have found that the simple transparent dish and milk-bottle covers sold by five and ten cent stores serve the purpose well and are durable and waterproof. They come in a wide variety of sizes and can be purchased in a handy package of assorted sizes for a few cents. The open end of the cover is slipped over the cable or conduit end and held by the elastic band as in the

diagram. This is satisfactory for temporary use and for a permanent seal, tape is wrapped around the cover neck to supplement the elastic band. Covers can of course be removed and reused.

San Mateo, Calif. H G PACK

Quick Removal of Handhole Gaskets

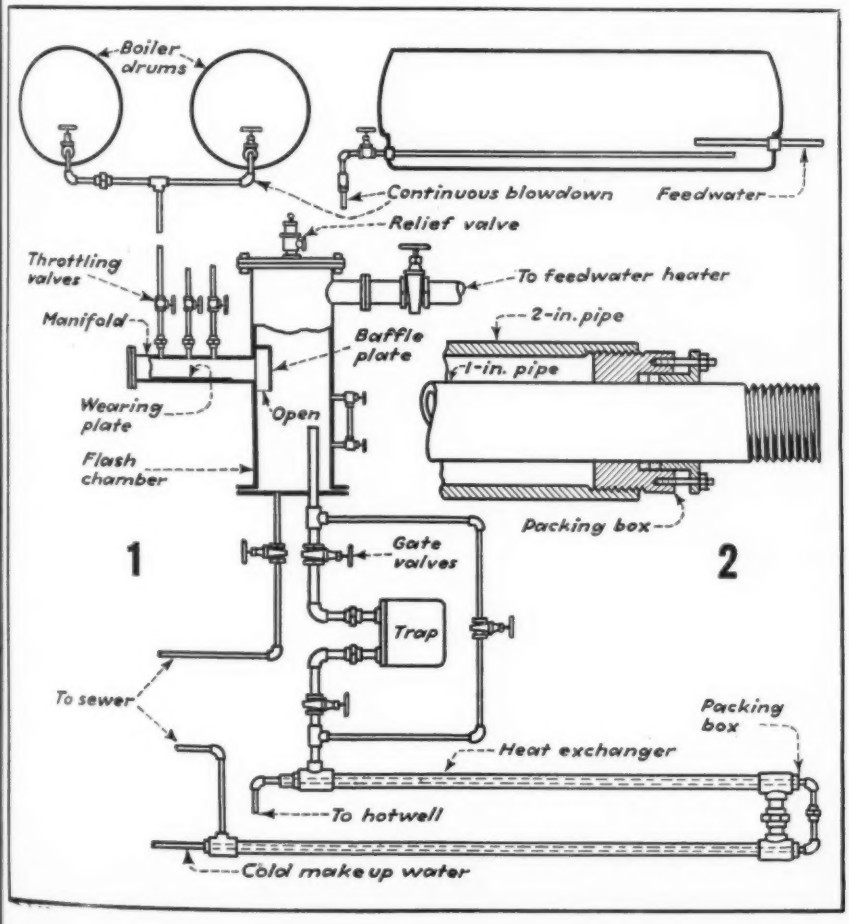
WATERTUBE-BOILER HANDHOLE plate gaskets are usually quite hard to remove by usual methods. When several hundred of them have to be renewed in a few hours' time cannot be wasted using a scraper or knife to take off the gaskets. One of the quickest ways I have found for doing the work is to take the handhole plate bolt firmly in the hand and rub the edge of the gasket back and forth over a rough surface, such as a floor plate, as in the diagram. When rubbing the gasket, turn the handhole plate at the same time. This will loosen the edges so that the dried gasket often flies off. If they don't, the gaskets are usually in such condition after being rubbed that what is left of them can be easily removed with a file or scraper.



Great Neck, N. Y. S M ELONKA

Builds Continuous-Blowdown System

IN THESE DAYS of priorities and other restrictions on the purchase of power-plant supplies the operating engineer frequently has to build what he cannot purchase. Therefore when we wanted a continuous-blowdown system for our three watertube boilers we decided to build it. The diagram shows the results of our efforts.



We first drilled and tapped the two-rear-drum headers of each boiler for a 1¼-in. steel boiler bushing. A standard ¾-in. black-iron pipe was run from the bushing inside the drum to about a foot beyond the open end of the internal feed pipe. Outside the boiler we used extra-heavy steel pipe and fittings. To make the manifold we took a piece of 5-in. pipe, 2 ft long, with a bolted flange on one end, and welded the other end to the flash chamber.

To take the wear from the discharge of the blowdowns we tack-welded a ¼-in. plate to the bottom of the manifold. When it is necessary to replace this plate it can be easily removed by a few sharp blows with a hammer and chisel. Nipples are welded to the top side of the manifold for connection to the boilers and the throttle valves are an extra-heavy design for this severe service.

The flash chamber we made from a 4-ft length of 12-in. pipe, by attaching a flanged head at each end and welding fittings to the side of the pipe for the necessary connections. A baffle plate made from one section of a 10-in. length of 6-in. pipe split longitudinally connects to the inside of the chamber around the discharge from the manifold. The top of this baffle is closed so that

steam and water from the manifold are directed down into the flash chamber where they separate. A relief valve was connected into the top of the flash-chamber and set for 12 psi pressure, the normal exhaust pressure in the plant being 10 psi.

In the bottom of the flash chamber are two connections, one of which leads to a large-capacity trap. The trap connection threads about 10 in. up into the flash chamber to keep sediment out of the trap. This sediment is blown away to the sewer through a second 1¼-in. connection tapped into the bottom of the flash chamber.

The trap discharges into the heat exchanger which is made of two 18-ft lengths of pipe, to the end of which are threaded 2-in. tees. A 1-in. pipe runs through the center of each 2-in. one, and at its left-hand end (in the diagram) threads into a bushing with its ends extending far enough through for a pipe connection. At their right-hand ends the pipes extend through packing boxes, as shown in Fig. 2. The two legs of the heat exchanger were then assembled and connected as Fig. 1 to obtain counter flow of hot and cold water.

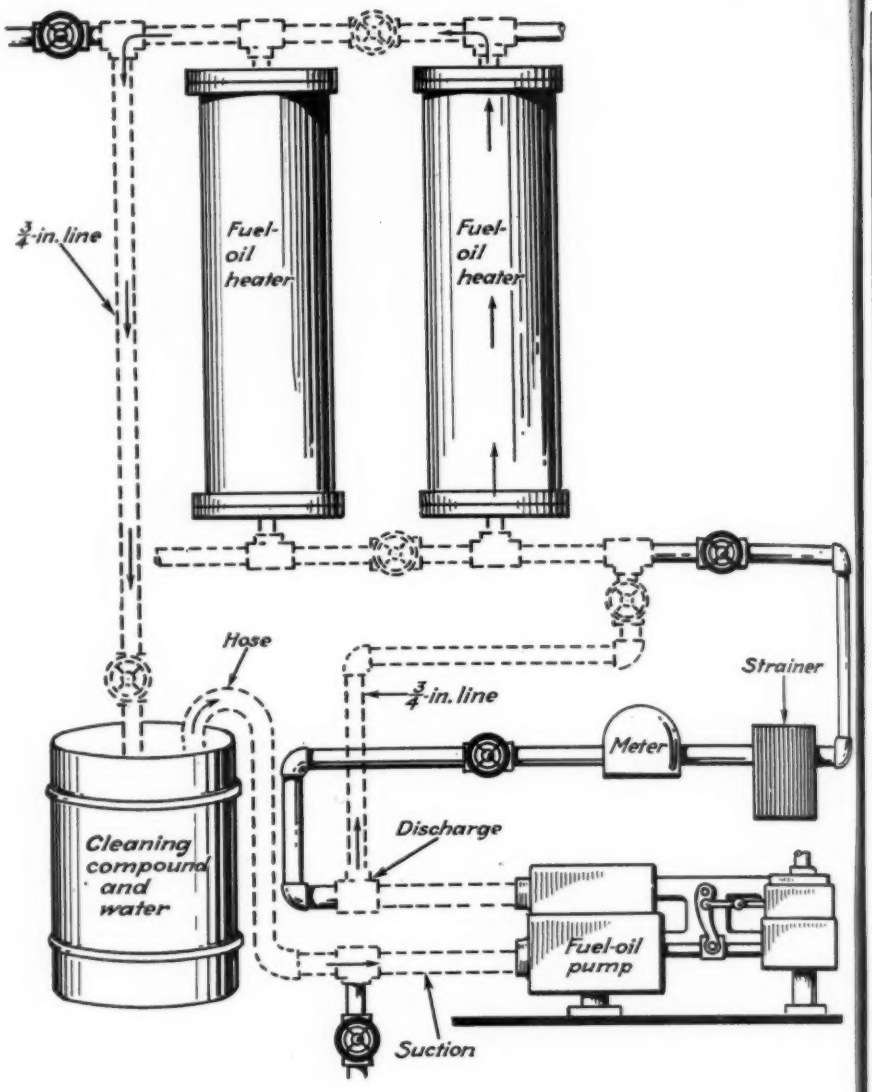
In operation, blowdown leaves the boiler drum at its most concentrated point. The gate valves outside the drums provide a safety shutoff in case of a pipe failure, and are closed and opened at regular intervals to insure that they are in working condition. The throttle valves are adjusted to control the blowdown to maintain a specified concentration in the boiler. Once a day the regular blowdowns are used to clean out the mud drums. Twice a week we full open the throttle valves for a few seconds to clean out any dirt that may accumulate in the blowdown lines.

This continuous-blowdown system has worked satisfactorily; permits us to hold the concentration in the boilers within close limits; and we estimate that the heat exchanger has saved us several hundred dollars in fuel cost.

Peabody, Mass. OLIVER RANTANEN

Difficult Cleaning Job Made Easy

RECENTLY I WORKED on a ship where they had considerable trouble keeping the fuel-oil heaters clean. Unless the heaters were taken apart and the tubes cleaned with wire brushes every trip it was impossible to heat the oil to the required temperature. Dismantling the heaters for cleaning was a difficult and disagreeable job because they were in an inaccessible part of the fire room.



To overcome these difficulties I purchased, when the ship was in New York, 50 lb of a cleaning compound. Then when we got to Santos, Brazil, for a four-day stay in port, I fitted temporary lines to the suction and discharge of the auxiliary fuel-oil service pump, as indicated by the full lines in the figure. To provide a hose connection I replaced an elbow in the suction line with a tee. From the free end of the tee a short length of hose extended into a large oil drum filled with a solution of water and cleaning compound. Two tees were installed in the discharge line to bypass the meter and strainer and also to let the main fuel-oil pump operate the donkey boiler while the ship was in port.

With the fuel-oil service pump we circulated the solution through the ten heaters, one at a time for about two hours. After the heaters were cleaned in this way, steam at 90 psi would keep the oil at 225 F, whereas before the cleaning, steam at 200 psi would maintain oil temperature at only 185 F.

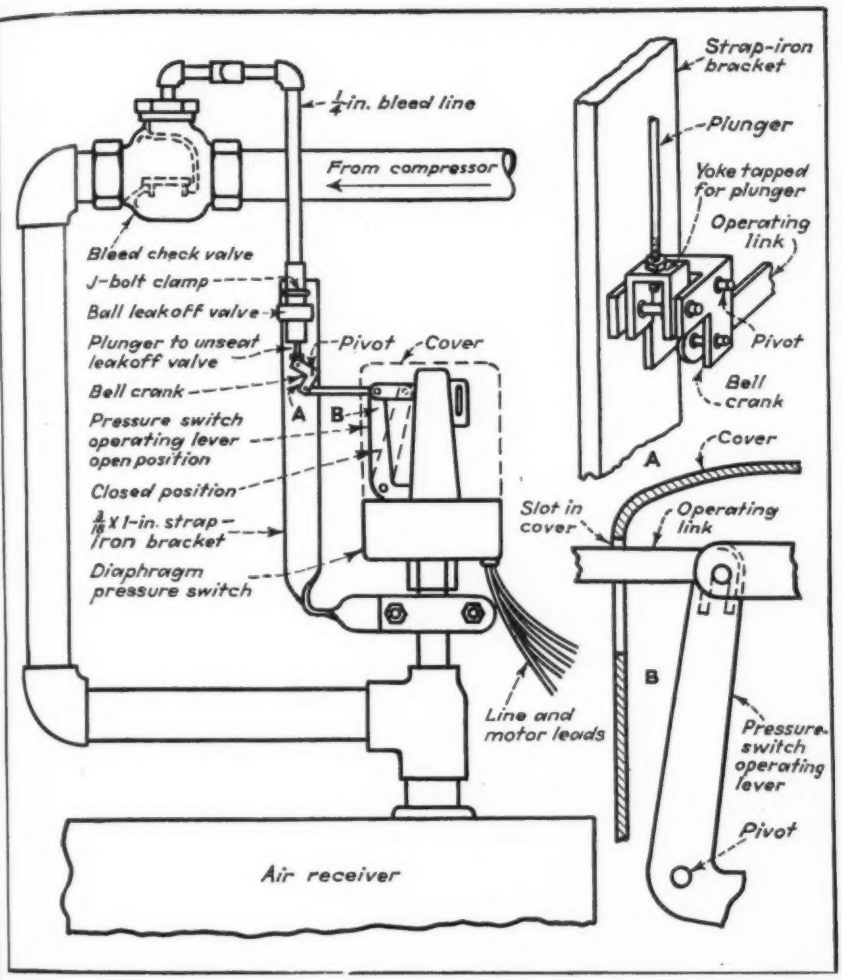
When this method of cleaning proved so successful, permanent connections were made in the oil lines for doing the job. Then when the heaters needed cleaning the solution was mixed in the drum, the hose connection made and the necessary valves closed and opened to provide the desired circuit for the solution and the pump started.

Great Neck, N. Y. S M ELONKA

Leakoff Valve Improves Air-Compressor Operation

WHEN I TOOK OVER the operation of some power-plant equipment I found a small belt-driven air compressor that did not operate properly. An ordinary swing check valve in the discharge line did not close leak proof. As a result full pressure remained in the line between the valve and compressor when the compressor was shut down. This made it necessary for the motor to start the compressor against full line pressure, for which it did not have sufficient torque.

To correct this condition we installed



a standard bleed check valve, for use on air compressors, in the air line between the compressor and receiver, as in the figure. The pressure switch did not have a leakoff valve so we installed a ball type. We then connected the pressure switch operating lever through a lever and bell crank to lift the ball off its seat. Opening the leakoff valve permits pressure from the receiver to seat the bleed check valve securely and also bleeds off all pressure in the line back to the compressor. This allows the motor to start the compressor unloaded. Figs. *A* and *B* show details of construction of the connections between the pressure switch and the bell leakoff valve.

Several months operation of this device has revealed but one slight defect. Occasionally the leakoff valve ball does not seat properly and permits a small amount of air to escape. This loss, however, has been negligible.

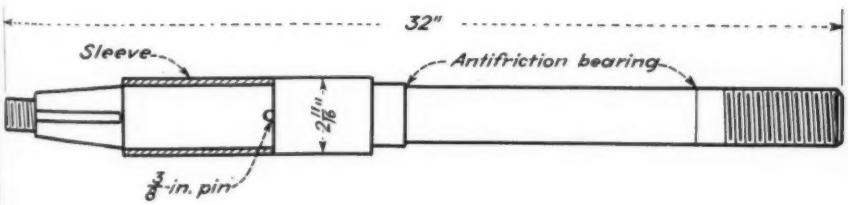
Tecumseh, Kan. H M NAYLOR

Stop on Work Bench Saves Small Parts

TO PREVENT LOSS of small parts from a steel work bench, one plant placed a stop along the front of the bench, as in the photo. This stop was formed from a length of half-inch round iron, welded to the bench top some four inches from the edge, and with bead run along the inner edge to prevent loss of small items under the stop. This round iron is not large enough to interfere with regular use of the bench top, yet affords sufficient lift to flat objects to enable a bar to be inserted for lifting to engage crane hooks or hoisting chain.

At one end of the bench surface is left clear for about 18 in. to facilitate cleaning and, when the bench is used outdoors, for draining water which may fall on it.

Houston, Texas CHARLES C LYNDE



Shaft Sleeve Solves Pump Trouble

THE SHAFT in one of our end-suction brine pumps became so badly worn in the stuffing box that it was impossible to keep the brine from leaking through the packing, getting into the antifriction bearing on the pump and destroying it. We ordered a new shaft from the pump manufacturer, but delivery took so long we had to do something to keep the pump in service.

I took the shaft out and had the part in the stuffing box turned down ½ in. We then made and installed a Ni-resist iron (other metal could have been used that would suit the conditions) and installed it on the shaft, as in the figure. This bushing was made slightly long so that when the impeller was tightened on the shaft it would press the sleeve hard against its shoulder. As an extra precaution against the sleeve turning on the shaft we drilled the sleeve and shaft for a ⅜-in. pin, as shown.

Salt brine is very destructive to most metals, but in the future we do not expect serious trouble with this pump except to renew the shaft sleeve when necessary, at a small part of the cost for a new shaft.

Goderich, Ont. GEORGE BARRETT

READERS' PROBLEMS

Questions from Our Readers

Question 1

Artificial Loading of Alternators

IT MUST BE A COMMON OCCURRENCE *these times for engineers to be called upon to arrange artificial loading for large natural gas and diesel engines in order that heat-balance figures and performance data be determined on the site, particularly with units erected overseas; and I am sure it would be of considerable interest to see how engineers overcome this difficulty.*

In our particular case it will soon be necessary to load a 1500-hp natural-gas engine driving a 1000-kw 2300-v 3-phase generator. A similar unit has already been installed; this was loaded by a water resistance which proved unsatisfactory.

In Great Britain 500 volts dc is regarded as about as much as can be safely used when loading by water rheostat, and this is invariably used for testing at the docks where there is an abundance of water. It is not convenient to load our machine from the panel, although it is thought loading may be possible by motoring some small emergency 300 kw diesels; by virtue of the panel layout and the obvious limitations of this method it has not been seriously considered.

I am also familiar with loading by resistance elements using a fan for dissipation of heat. This for a single unit is expensive, even assuming resistance wire could be obtained. However there are undoubtedly engineers who have overcome this problem and I would appreciate hearing what methods were used.—CEJ

Question 2

What Is the Generator Power Factor?

OUR GENERATING PLANT *is tied in with others on a large power system. When the system power factor is low, we sometimes put a generator on the bus to supply reactive kva only, leaving the remainder of the plant to carry a kilowatt load at a moderate power factor. The machine draws a small load from the system which is shown by the integrating kwhr meter running backwards.*

With 2000 amps per phase, practically all wattless on this machine, an hourly reading of −400 kwhr, and a bus voltage of 2100 volts, what will be the power factor of this machine from the equation $P = E\ I\ (1.73)\ pf$*?*

Every hour we total the station kilowatt-hours and the amperes per phase of all generators to find the station average power factor. Should the above-mentioned 2000 amps of the motoring unit be added in with the plant load to determine the average power factor of the station? Is this leading current which will improve the station average power factor? Would it be possible to have this problem illustrated with a simple vector diagram.—MGW

Air Compressor Protection

Answers to Jan Question 1

The Question

WE HAVE RECENTLY *installed a complete compressed-air system in our plant. Two-stage 250-psi compressors start, load, unload and stop automatically by pressure control. Lacking complete knowledge on the operation and care of air compressors and having heard of the dangerous possibilities of compressed-air explosions I would appreciate suggestions from* POWER *readers on protection against this hazard. Is there any device which can be made in the plant shop that will shut the machine down on high air temperature? Could a suitable thermostat be attached to the discharge pipe and wired into the motor control circuit or should we use a flow switch in the cooling water piping?*—BVN

Air Compressor Operating Pointers

IF BVN IS TO OBTAIN the best and safest service from his air compressor there are several things which he should do, as follows:

Keep all bearings tight, clean, and well lubricated with a high-grade oil.

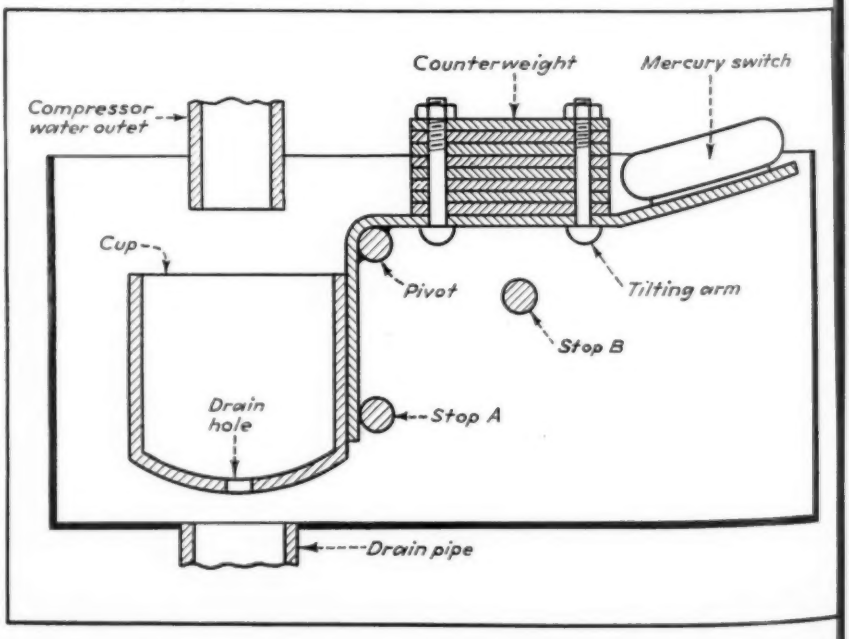
Keep the cylinders lubricated with high-grade oil, using the minimum amount of oil that will do the job.

If the compressor has an intercooler or aftercooler keep the surfaces free of scale and oil accumulations.

Keep compressor valves in good condition.

Take the air supply from the coolest location available and make certain that the suction has first-class air filters of ample capacity.

Do not neglect to keep the air filters clean, as a dirty air supply results in undue wear of the cylinders and gumming of the valves.



Keep the circulating water flowing whenever the compressor is operating. (A tilting cup shown in the sketch can be built into the circulating-water line so it will stop the compressor should the water fail to circulate.)

A "strap on" type high-limit thermostat may be fastened to the air discharge line close to the compressor and wired into the motor control so it will shut down the compressor should the air temperature increase.

Franklin, Ind. I A BUTCHER

Arrange Piping to Prevent Emptying

BVN ASKS ABOUT protection for air compressors based on a fear of cooling-water failure.

I suggest that, in addition to the pressure-relief valve on the compressors, he install a temperature relay to open the motor circuit on approaching dangerous temperatures. In addition, the cooling-water piping should be so arranged that the water spaces cannot drain or empty in case of flow failure, but will stand full of water.

If pressures are normal, jackets clean and the right amount of suitable oil used, there is little danger of explosions. Most explosions are caused by using too much oil which builds up in pipes and receivers.

Albuquerque, N. M. E A ROBERTS

Cautions Against Homemade Devices

I SHOULD LIKE TO ADVISE BVN against the use of any homemade device for protecting compressors although I am in full accord with installing commercially manufactured products.

BVN cannot expect safe protection of his equipment with a thermostat installed in the air discharge line; however, he could use an aquastat in the cooling water outlet and wired in with the motor control circuit. Should he desire an audible signal, install another aquastat wired in with transformer and bell; this should be set a few degrees below the motor trip aquastat, to give advance warning without shutting down the unit.

These aquastats should be of the screw in or insertion type and not of the attached or surface-mounted type. In addition it is advisable to install a pressure control in the water-supply line and a pressure control in the air line or air receiver as a high limit switch. This is a precaution if or when the present pressure switch or relief valve should become inoperative. These above mentioned controls should not exceed $30.00 plus five hours work.

Schenectady, N. Y. CARL BACHMANN

Install Safeguards In Air Discharge

ONE OF THE MOST IMPORTANT things for BVN to watch is the kind of cylinder oil that is used. This oil should be purchased from a thoroughly reliable source and should be of the proper grade, ordinarily a light oil with a flash point of about 420 F and a fire point of about 500 F. Too much oil in the cylinder contributes to fires in air compressors and no more oil should be supplied than is required to give satisfactory lubrication. The use of a mechanical positive-drive lubricator is also desirabe to assure maintaining the proper feed of oil.

If there is any danger of cooling water stoppage from foreign matter such as leaves and twigs, twin strainers should be installed in the inlet water line. Twin strainers are necessary so that one can be cleaned and the other used without any curtailment of compressor operation. The outlets from the various water-cooling jackets should discharge into an open drain so that the water flow can be easily checked.

The compressor air intake should be located so that no abrasive matter or inflammable gases may be drawn into the compressor. If it be necessary to use a filter, take care that the material used for cleaning the filter does not contain any volatile inflammable gases which could be drawn into the compressor.

Fires have occurred in air distribution lines resulting from an accumulation of excess oil. The best protection against this hazard, other than being sure that the minimum amount of cylinder oil is being used, is the installation of aftercoolers, which help to precipitate the excess oil out of the air and also reduce the air temperature below the danger point.

Safeguards for the compressor can be provided by installing, in the high-pressure discharge pipe, near the cylinder, a recording thermometer with accompanying controls. This equipment would be adjusted to function as follows:

1. Sound an alarm when the temperature of the high pressure air rose a certain amount above the normal discharge temperature, and

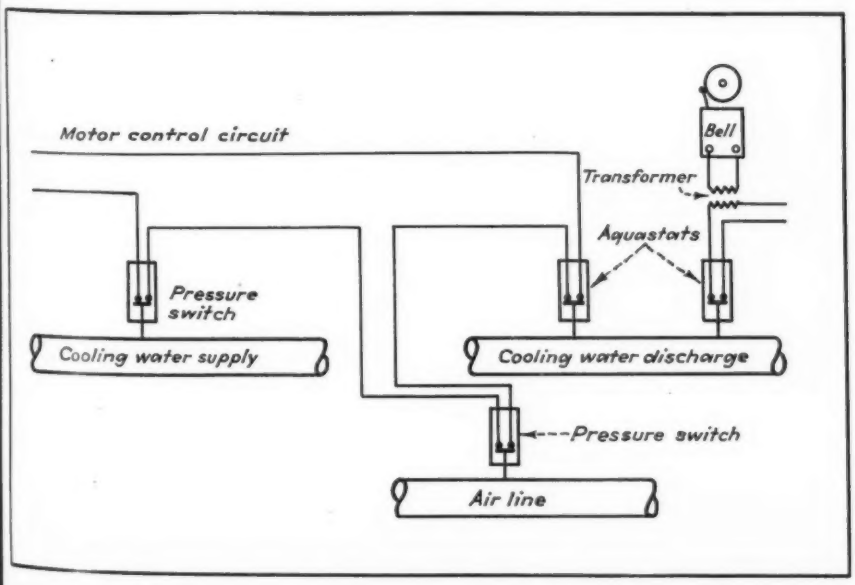
2. Shut the compressor down automatically if the temperature of the discharge air continued to rise and approached the flash point of the oil.

Such equipment could be made in the plant shop, but more satisfactory and reliable units could be secured from manufacturers specializing in that line. The installation of this control equipment in the cooling water line would not be satisfactory as there would be too much lag between the rise of the air and water temperatures, and air temperature would not be accurately indicated.

Pittsburgh, Pa. C J WYROUGH

Recommends Oil Feeding Rate

SEVERAL DISASTROUS EXPLOSIONS have occurred in air compression systems, and in most cases were found caused by either excess lubrication, which caused the valve to become carbon-



ized, or by using kerosene for cleaning valves. When cleaning, the kerosene should be thoroughly removed, and the valves allowed to "air" themselves dry. In other words, long enough to allow a complete evaporation of the cleaning fluid.

The Compressed Air Society recommends the following feed for oil in lubricating compressor cylinders: One drop of oil per minute for each 600 sq ft of cylinder wall swept by the piston per minute in an 8x8-in. cylinder, six drops in a 24x24-in. and twelve drops in a 42x42-in. compressor. The oil should have a low distillation end temperature, and be free from moisture or gum deposits.

In BVN's case, the 2-stage compressor will have an intercooler. The maintenance of this intercooler depends on the source of cooling water. It should be inspected annually, and the tubes kept clean and free from sediment.

Regarding automatic devices, and temperature-control mechanisms for further protection, it is well to consider the installation of a circulating water cutoff switch, which will automatically stop power to the driving unit in the event of circulating water failure. This switch could be made from odds and ends in the shop. The installation of such a device will prevent the operation of the compressor until the circulating water is turned on.

Fusible plugs or so-called soft plugs may be installed in the air tank heads or discharge line for further protection.

Grand Rapids, Mich. J M GORRIE

Use Good-Quality Oil

THE POINTS TO BE CONSIDERED in operating BVN's compressors are the amount of water and oil to be used in the respective systems. If the cooling system isn't operated efficiently, it will mean more water used than is necessary. Insufficient water in the cooling system causes high air temperature and breakdown of the oil's lubricating qualities.

An inferior quality oil will break down under the heat in the compressors, resulting in excessive wear and possible scoring of cylinder walls. Air compressors require an oil of high flash point to eliminate as much as possible the danger of explosions. Improper oil feed to the cylinders may cause carbon deposits if too much oil is fed to cylinders; broken piston rings, scored cylinders and excessive wear if insufficient oil is fed to cylinders.

Philadelphia, Pa W T MULLEN

No Substitute for Operator's Rounds

FOR AN AUTOMATICALLY CONTROLLED installation such as described by BVN it would seem essential to have a thermostat control on cooling-water inlet. The bulb can be located in the air-outlet piping and operate the water valve directly or through a pilot valve, depending on the regulation desired. A switch can also be fitted to interrupt the motor power supply through the motor control at some temperature above normal to guard against water supply failure.

The compressor manufacturer should be consulted as to the control and method of installation, as such equipment is usually standard.

Control equipment should be used to supplement, and not substitute, the regular inspection rounds of an experienced operator.

St John, N. B. C G CLARK

Can Oxygen Be Removed?

Answers to Jan Question 2

The Question

WE HAVE TWO *100-hp boilers for heating our office and shops. Steam is generated at 100 psi and supplied to fin heaters. Condensate from these heaters returns direct to the feedwater tank. Boiler pressure steam reduced to 10 psi feeds all office building radiators. Condensate from radiators is returned to the feedwater tank by a vacuum pump. A float-operated valve in the raw-water makeup line controls water level in the feedwater tank. Fuel oil heater condensate is discharged to waste. This loss, together with feedwater-tank vent loss, requires approximately 10% makeup from raw water.*

Boiler-feed pumps take water from the feed tank and pass it through a closed heater and then to the boilers. Two boiler-feed lines are installed between the feed pumps and boilers, each line fitted with a pressure-regulating valve discharging to feedwater tank.

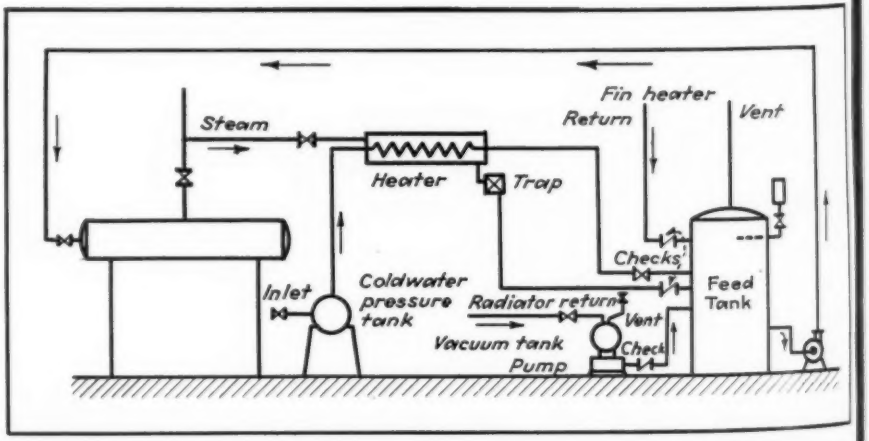
When the boilers were first installed we had considerable scale formation. This trouble was soon corrected by adding periodic chemical doses to the feedwater. Our present trouble appears as corrosion of the steaming tubes. Tests have shown that our makeup water contains considerable quantities of oxygen. By circulating the feedwater through the heater and back to feed tank we have been able to reduce the oxygen content to the recommended minimum. This worked satisfactorily until we began shutting the boilers down over night to conserve oil. Partial cooling of the water in the feed tank caused a heavy absorption of oxygen through the feed-tank vent line.

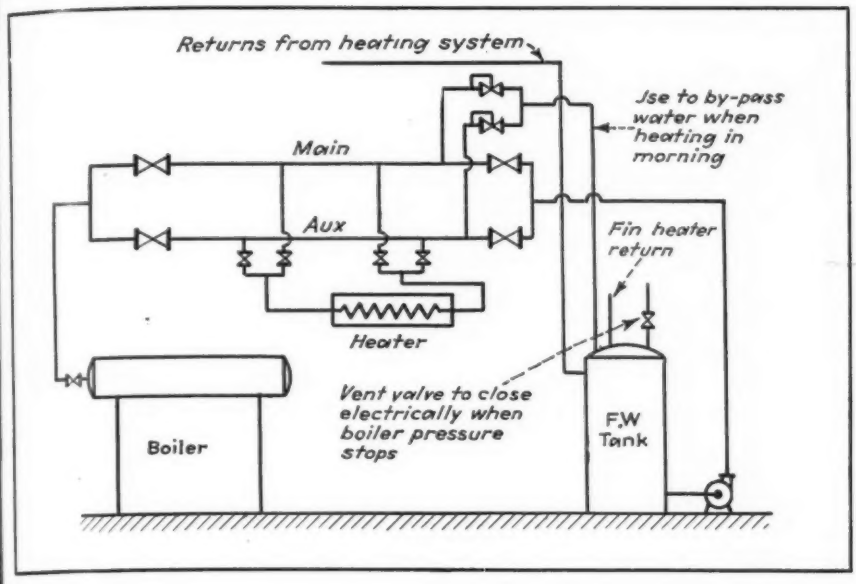
It is impossible to install a deaerating heater and we do not care to add large amounts of chemical to react with the oxygen. Could we pipe all condensate direct to the tank and use the vacuum pump to maintain a negative pressure inside or would vaporization of the 180-F water cause excessive loss? What other methods could we use?—WFF

Air May Be Entering Condensate Returns

TEN PERCENT raw water makeup for a plant is not much for two boilers, and if the oxygen is in the raw water, then the trouble is in the method of delivery.

If the water comes from city mains, then the trouble lies in the condition of the main. On the other hand if the raw water is pumped from a well, then the trouble will be found in the method of pumping delivery, and it would be advisable to install a cold-water tank. However, where condensate return pipes are underground, there is also a possibility that the pipes may leak, and





Install Automatic Vent Valve

I BELIEVE THE OXYGEN can be removed or controlled as good as before WFF ran into this situation.

My idea would be to bring all returns back to the feed tank or receiver by proper trapping or draining. With the drainage properly connected, the vacuum pump can be eliminated for the present. As soon as the steam pressure goes down and the vacuum pump is shut down the condensate remains in the line.

If in the morning there is sufficient water in the boiler so as to be able to bypass the feedwater from tank to the heater and back to feed tank, the water will be heated to such a temperature that the oxygen will be vented from the tank. It would be a good idea to have the temperature on the heaters controlled to a point where the water, returned when bypassing in the morning, would not be more than 200 F.

If the boilers must be shut down during the night, then a temperature or an electrically operated device can be installed to close a valve in the vent line when the pressure drops down to zero. The vent valve also can operate on pressure differential, and as soon as the tank pressure starts to raise, the valve in the vent line will open.

Philadelphia, Pa. W T MULLEN

air may be drawn through the vacuum pump to the feed tank.

The best way to eliminate oxygen in feedwater is to bring the water to boiling point, which permits the gas to pass to the atmosphere. (See sketch, p. 112).

It is suggested that the heater be used for heating the raw water, which may be pumped from the cold-water tank through the heater and into the feed tank. This tank should be amply vented at the highest point, the fin heater returns to be as shown. The returns from the office building should be connected to a vacuum tank separate from the feed tank, and the condensate then pumped into the feed tank.

The use of a vent in the feed tank is strongly recommended. If the feed tank is to be used as a part vacuum tank using the vacuum pump to maintain a negative pressure, then there would be no possibility of eliminating the gas in the returns.

Grand Rapids, Mich. J M GORRIE

Install Vacuum Air Valves On Radiators

IN WFF'S QUESTION a change may be possible involving removing the automatic valves on the radiators and substituting vacuum air valves. Vacuum air valves will remove the air in the radiators when the steam pressure within the radiators is slightly above atmospheric.

For best results in the vacuum return system carry just enough vacuum to allow a prompt removal of water and air from the radiators. Radiators that are furthest away should carry about 2 in., and at the pump the vacuum may be held from 2 to 20 in., this depending on the length of the return and the height that condensate must be lifted.

I would suggest WFF install a smaller feed tank with heating coils installed as shown in accompanying sketch. The heating medium for these coils can be supplied by running the exhaust steam from the feed and vacuum pumps through them. This feed tank, of course, will also be vented by tying into the main vent line. It is possible with this arrangement to heat the feedwater to 212 F. Exhaust steam used in this manner can realize a saving of approximately 1% of fuel for each 11-F rise in temperature of water.

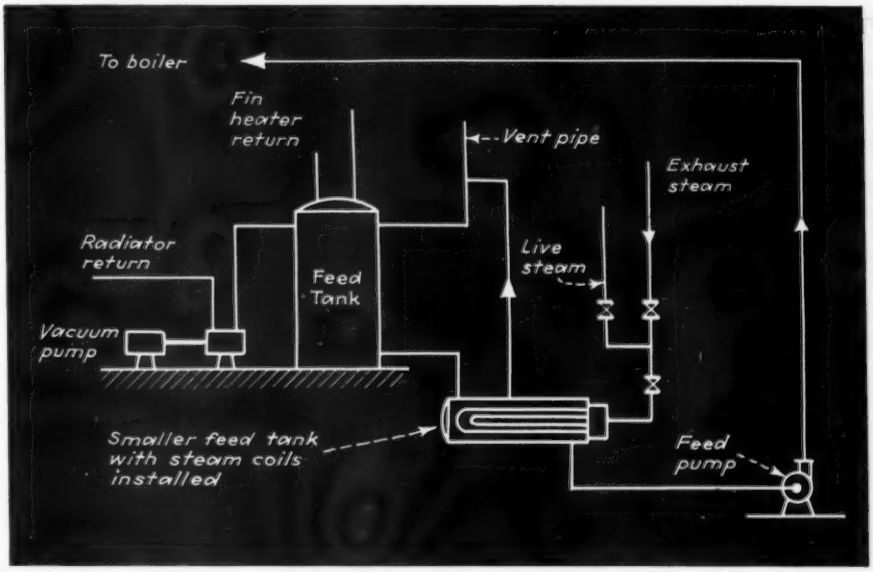
A live steam line may also be cut in at the heating coils with proper valve hookup so that feedwater may be heated while steam is being raised after the shut-down period. In this smaller feed tank another float shutoff valve should be installed to keep a proper water level in the tank.

Fairview, N. J. M N GOZDENOVICH

Heating And Agitation Drive Off Oxygen

REMOVING DISSOLVED GASES from water

(*Continued on page* 150)



Q&A QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

1 — *Boiler Regulations and Methods of Study*

For the next twelve months, every number of POWER *will bring you another installment of this series. Without beating about the bush, Alex Higgins asks and answers practical questions regarding power equipment—its construction, principle, maintenance, efficiency and safe operation. In outstanding fashion he drills the power-plant beginner, polishes up the knowledge of the old-timer, helps all comers to pass engineer examinations and win certificates of higher grade*—EDITOR

THE PROSPECTIVE CANDIDATE for a certificate as an operating engineer must meet requirements respecting age, experience and character as laid down by local laws and rules. These can usually be obtained in printed form from the departments administering boiler inspection and examination of engineers.

He is expected, also, to be thoroughly familiar with all laws and regulations covering operation of power plants, particularly those defining qualifications, duties and responsibilities of the engineer in charge of a plant and the penalties he may incur for neglect.

Rules for Boiler Construction: The various codes drawn up by the American Society of Mechanical Engineers in connection with the design, construction and installation of boilers and other pressure vessels have been adopted over practically all of the North American continent. These codes are constantly being revised and kept in line with the latest practice. They provide a service that could not possibly be equaled by any single local organization. Common agreement on a uniform and reliable set of standards is also a tremendous help to designers, manufacturers and operators.

In addition to these ASME codes, most departments or authorities concerned with the operation of power plants and the licensing of engineers draw up supplementary regulations covering inspection fees, examination requirements and other items that may have a purely local application.

Greater uniformity in examination requirements and candidates' qualifications for engineers' certificates would, no doubt, be a step in the right direction, but there is wide disparity in licensing standards and little hope of immediate change. There is, however, a tendency in many places to raise very low standards of qualification.

Engineering Standards: Matters that do not come within the scope of the codes and other published standards of ASME are usually covered in the published standards of such other organizations as the American Society for Testing Materials and the American Standards Association, in the U. S. A., and the Canadian Engineering Standards Association, in Canada.

Students' Educational Background: Three things are essential to proper understanding and answering of examination questions:

1. Sufficient command of English to express ideas clearly after ascertaining the exact meaning of question.
2. A good working knowledge of

(*Continued on page* 116)

ALEX HIGGINS, as an engineer, writer and instructor, is preeminently qualified to write this important series on examination questions, covering all phases of power-plant work and based on actual practical experience.

Ever since he completed his course at Royal Technical College in Glasgow, Scotland, Mr Higgins has been intensively engaged in engineering activities—plant construction and operation, consultation, teaching. For several years in Great Britain, and later in western Canada, he erected and operated power plants, installed mining machinery, was mine master mechanic. Next, he lectured on steam engineering and joined the staff of the Alberta Government's Provincial Institute of Technology to teach engineering mathematics and to write correspondence courses in mining. Then followed practical experience as mine superintendent, operator of coal mines, heating contractor, developer of oil fields. He also rejoined the Institute as head of the Mining Department.

At present, he is a consulting engineer in Calgary, specializing in mechanical engineering of mines and industrial power plants; supervisor of engineering correspondence courses and evening classes at coal-mining centers for the Alberta Department of Education; author of correspondence courses in steam engineering, mining, surveying, mathematics, etc, conducted by the provincial Government.

He holds a first-class operating engineer's certificate for Alberta, mine manager's certificates for Great Britain, Alberta and British Columbia. He is a member of the American Society of Mechanical Engineers, the Engineering Institute of Canada and the Alberta Association of Professional Engineers.

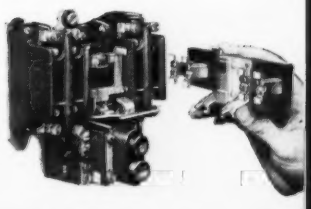
Mr Higgins writes, in answer to a telegram, that he was born in Ayr, Scotland 53 years ago, is married, has a daughter at home and a son who is a squadron leader in the RCAF. He doesn't smoke or drink anything stronger than coffee, plays golf in summer, curls in winter, goes on prospecting trips whenever he can get away and, he concludes, that's about all. Although he doesn't say it, we know he'd appreciate a word from you as to how you like his series. His address is 3620—8A St West, Calgary, Alberta, Canada.

EVERY machine in this fight from the largest ship afloat to the smallest tool on the production front has to do its job without faltering when the time for duty arrives. And every man responsible for performance knows you have to *keep 'em clean to keep 'em working.* Dust and dirt are ever-present saboteurs that must be kept in check. What are *you* doing about motor control? Are you keeping motor control contacts clean by a strict maintenance routine...or are you now enjoying the extra value of having insisted upon Cutler-Hammer Motor Control with the *dust-safe* VERTICAL contacts that *shed* dirt and *keep themselves clean?* This important *basic* difference in motor control is doubly vital today when men are too scarce to waste on needless maintenance and unhalting production is imperative. When you buy motor control specify Cutler-Hammer. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

CUTLER·HAMMER
MOTOR CONTROL
C·H

Copyright 1943
Cutler-Hammer, Inc.

Cutler-Hammer Vertical Contacts
OUT IN THE OPEN—NOTHING TO HIDE. You can see the clean contacts in Cutler-Hammer Motor Control as soon as you open the case. They're out in the open where they can work cooler and last longer.



Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

elementary mathematical operations.

3. Ability to sketch neatly and to draw in proportion.

The first is needed to answer questions for any grade of certificate; the second, more particularly for higher grades; the third, essential for higher grades but useful for all.

Men preparing for higher grades of certificates must have considerable knowledge of elementary mathematics and mechanical drawing. Mathematics required for lower grades seldom covers more than simple arithmetic, but accuracy in solving even the simplest arithmetical problems is always important. Correctness of all mathematical solutions depends, in the last analysis, on accuracy in addition, subtraction, multiplication and division.

Reference Magazines and Books: All operating engineers should subscribe to one or more engineering magazines and have at least a few good textbooks dealing with the various branches of their professions. Editions should be fairly recent, as engineering practice has changed considerably in many respects within the past few years.

Drawing Instruments and Drawing: Ability to make a neat, freehand sketch and a scale drawing with instruments is a valuable asset to any engineer in his daily work, and is particularly useful in an examination when a sketch or drawing may answer a question better than several pages of writing. Drawing is the universal language of the engineer.

Very few people have a knack for really good freehand work but neat sketches, not necessarily to scale, may be made with a few drawing instruments, such as compasses, 60 and 45 deg triangles and a 12-in. rule. Most of the sketches for this series were made with drawing instruments, not to scale, but approximately in proportion. [As published later in this series, the author's clear mimeographed sketches will be traced by POWER's draftsmen.]

Every progressive engineer should own a complete drafting outfit, including compasses, spring bows, dividers, drawing pens, drawing board, T-square, 60 and 45 deg triangles, protractor, drawing paper, pencils, eraser and drawing ink.

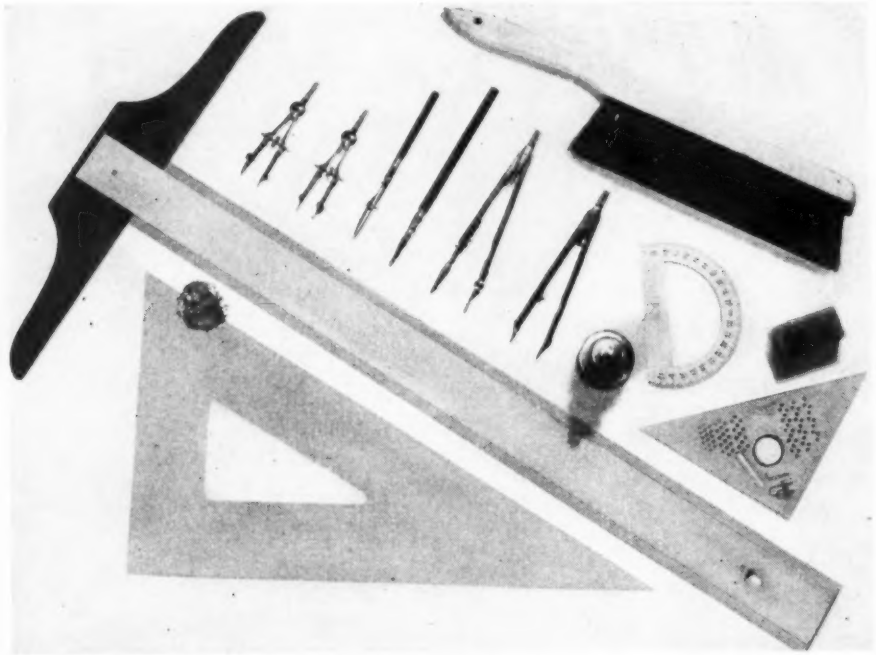
Boiler Acts and Rules Governing Examinations: Examiners sometimes ask about laws and rules governing power-plant operation and qualifications and duties of the engineer. Such questions can be answered by quoting the particular section or sections of the act or regulation mentioned in the question. No particular instruction or advice is needed on the method of answering this type of question other than to repeat that a candidate should get copies of all laws and regulations governing these matters and study them carefully, paying special attention to sections dealing with: *qualifications* of the engineer; *duties* of the engineer; *penalties* for neglect of duty or infraction of laws or rules.

An engineer is expected to be familiar with all laws, rules and regulations governing the conduct of his profession.

Questions Concerning Experience: If a candidate is asked about his experience, he should answer fully. Perhaps the best answer is a direct statement of the various positions he has filled, in the order held, plus a few particulars about each plant. Under question 3, two forms of this type of answer are given.

ASME Code and Local Regulations: Sometimes a candidate is allowed to take copies of the ASME Code and of local regulations into the examination room and to consult them freely. Whether their use is permitted or not, study the codes and regulations carefully beforehand, particularly the sections dealing with use and location of boiler fittings. Use of logarithmic tables, steam tables and slide rules is permitted at practically all engineering examinations.

At the Actual Examination: Arrange your work neatly. Number each page and leave margins around your writing. Number each answer to correspond with its question and leave spaces between answers. Always put down sufficient steps in working mathematical problems to explain how you arrived at the result. Write your answers plainly and state units in which answers are given; that is, feet (ft), inches (in.), or pounds per square inch (psi), as the case may be.



Because drawing is the native language of engineering, "every progressive engineer should own a complete drafting outfit, including compasses, spring bows, dividers, drawing pens, drawing board, T-square, 60 and 45 degree triangle, protractor, drawing paper, pencils, eraser and drawing ink."

Typical Questions and Answers

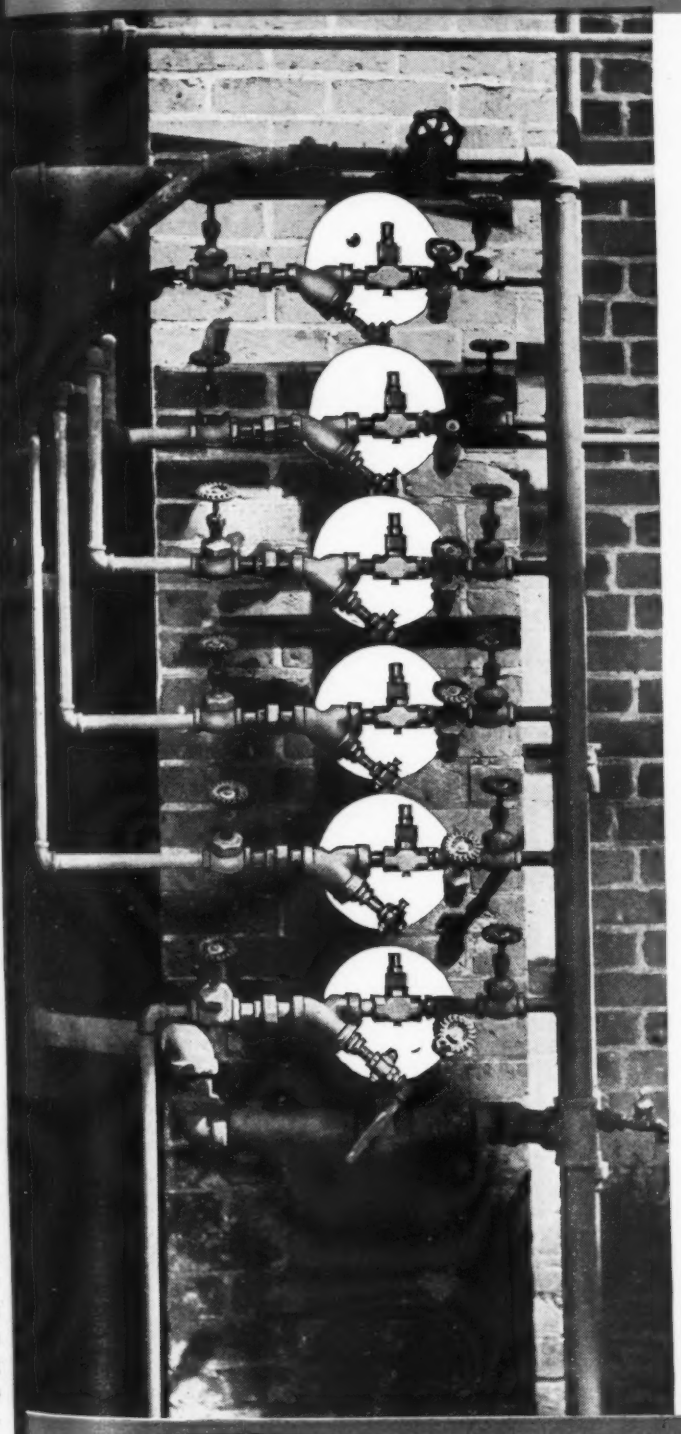
Some of the following questions and answers are on the foregoing topics and others are on routine duties of the engineer. Names used in the answers are, of course, purely imaginary.

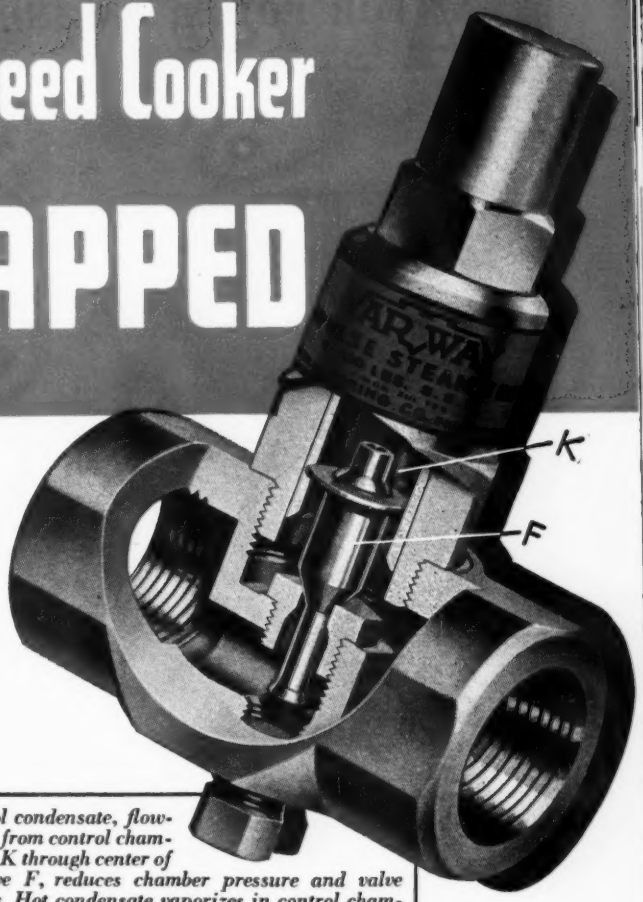
Q 1—What are the duties of an engineer in charge of a power plant?

A—He sees that his plant is installed so as to comply in every way with regulations governing these matters and that it is operated with due regard to safety and efficiency. He satisfies himself that his assistants are competent to perform their duties and are faithfully following his instructions and orders. He draws up rules, and sees that they are car-

(*Continued on page* 118)

World's Largest Cotton-Seed Cooker is YARWAY TRAPPED





Cool condensate, flowing from control chamber K through center of valve F, reduces chamber pressure and valve lifts. Hot condensate vaporizes in control chamber, raising chamber pressure and closing valve.

SIX YARWAY Impulse Traps and Strainers handle the big job of draining the heating coils of this six-high continuous cooker—largest ever built—at Magnolia Provision Co., Houston, Texas.

Ideally suited to the service—providing *continuous discharge on heavy condensate loads*, during heating-up periods, and *intermittent operation on light loads*—Yarway Traps answered this manufacturer's problem, completely.

Not only for *quicker heating* and *greater sustained heating efficiency;* but for many other distinct advantages—Yarway Traps are replacing less efficient, less dependable devices in many plants.

Have you investigated this trap about which users say,—*"saves fuel,"—"saves space,"—"easier and cheaper to install,"—"we like its flexibility on different pressures,"—"saves maintenance trouble and expense,"—"cheaper to replace with Yarways than to repair old-type traps,"* etc., etc.

See your local mill supply distributor or write for Bulletin T-1737.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia, Pa.

YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(*Continued from page* 116)

ried out, for general machinery adjustment and repair and for all routine operations, such as testing water gages, soot blowing, blowing down and washing out boilers. He draws up a log book form suitable for his plant and insists that it be an orderly record of all routine operations, repairs and happenings worthy of note in and around the plant. He personally inspects all important parts such as interiors of boilers, when they are shut down for cleaning; sees that all repairs and replacements are carried out as soon as reasonably possible; and reports immediately any serious defect to his employer or to the boiler inspector. As he is ultimately held responsible for the plant's safe operation, he uses his own judgment, in the event of any unusual or dangerous situation, as to whether to keep the plant operating or shut down.

Q 2—What penalties may be incurred by an engineer who is guilty of gross neglect of duty, or serious infraction of the laws and rules governing operation of power plants?

A—His certificate may be suspended or canceled. He may also be fined or even imprisoned, in extreme cases, when gross neglect of duty has resulted in grave bodily injury to other persons.

Q 3—What experience have you had as an engineer?

This question may be answered in either of two ways:

a By a list of jobs in the order held.

b By an account of experience in narrative form.

A—Following are examples of typical good answers to *a* and *b*, using fictitious names:

a "Jobs in the order held: May, 1929 to August, 1934. Acted as Shift Engineer in plant of the Armstrong Mfg Co, Ltd, Hillboro,—.

"Boiler Plant: Two 200-hp dry-back marine-type hand-fired boilers; two 5x4x6-in. boiler-feed pumps, duplex type; one Cochrane open feedwater heater; two large return traps for heating-system returns.

"Engine Plant: One 75-hp automatic, side-crank, horizontal, piston-valve, non-condensing simple engine, direct connected to a 50-kw dc generator; one 50-hp horizontal, slide-valve, non-condensing engine driving shafting.

"August, 1934 to date. Chief Engineer in plant of the Harrison Food Products Ltd, Newbury,—.

"Boiler Plant: Two 150-hp horizontal-return-tubular boilers, hand fired, two 6x5x8-in. duplex boiler-feed pumps; one 6x4x10-in. simplex pump for factory water supply; one open feedwater heater.

"Engine Plant: One 75-hp simple Corliss engine driving lineshafting; one 200-hp high-speed, automatic, simple piston-valve, center-crank, horizontal engine direct connected to a 150-kw ac generator, supplying current for lighting and plant motors."

Experience in narrative form:

b "I sat for and obtained a ——— Class Engineer's certificate in April, 1929; started in May, 1929 as Shift Engineer in the plant of the Armstrong Mfg Co, Ltd, Hillboro,—, and continued in that position until August, 1934. The boiler plant consisted of two 200-hp dry-back marine-type boilers, hand fired, with two 5x4x6-in. duplex boiler-feed pumps, an open heater and several large return traps for handling condensate from the heating system and processing machines. In the engine room we had one 75-hp automatic, side-crank, piston-valve, simple horizontal engine, running at 240 rpm and direct connected to a dc, 50-kw generator, and a 50-hp simple slide-valve engine running at 150 rpm and driving lineshafting.

ALEX HIGGINS IS RIGHT!

It's easier to pass engineers' exams if you know how to write good, clean English. If you want to brush up on the language, and need advice, send stamped, self-addressed envelope to the Editor of POWER, 330 West 42nd St., New York City, and ask for free list of books recommended for home study.

Largest Canadian Hydroelectric Power Plant

▶ WARTIME NEED for aluminum has required the building of the largest hydroelectric power development in Canada, according to a recent announcement of the undertaking by Canada's Munitions and Supply Minister C D Howe. Wartime censorship has withheld the story of the building of this huge water power development but enough has been revealed through government and corporation announcements and reports in Canadian publications to give a preliminary look at one of the world's mightiest hydroelectric developments.

Site of the new development, which is to be entirely used to provide electricity for aluminum production, is in northern Quebec, on the Shipshaw river, a tributary of the Saguenay river. Approximately 10,000 men worked on the project at peak periods.

The northern Quebec development was built in two and a half years as against five years taken for Boulder Dam. Last November, 18 months after work was started, the first 85,000 hp unit was placed in operation, the first of twelve such to go before the end of 1943, making a total capacity of 1,020,000 hp.

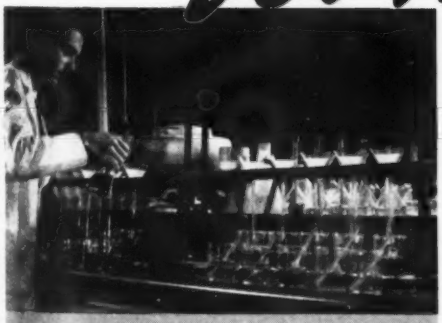
With the development of the Shipshaw power site Canada will have developed about one-quarter of the potential 43,700,000 hp of hydroelectric energy available in her streams and rivers. When the war started Canada had about 8,500,000 hp developed. At the beginning of 1943 this had increased to 9,226,000 hp, and during 1943 over 1,000,000 hp is to be added, mainly from the Shipshaw development. Most of the hydroelectric power developments, according to the official Canada Year Book, are in Quebec and Ontario. The Shipsaw developments will give Quebec more than half of **all** Canada's "white coal."

✪ ✪ ✪

Professor George B Karelitz, 49, mechanical engineering department, Columbia University, New York, died in that city January 19, 1943. Prof. Karelitz was active in the ASME Applied Mechanics Division, chairman of the Research Committee on Lubrication and chairman of the Standing Committee on Publications during 1942. At the time of his death he was a member of the Standing Committee on Publications for 1943. An outstanding authority on lubrication, Prof Karelitz also served as a member of a special committee on the rolling of steel.

You call the FIRE DEPARTMENT when your house is ablaze...

Call the NALCO MAN for Water Treatment!



In the Nalco laboratories, water treatment has been put on a basis of "find the correct answer in the first place and end the problem permanently." *(Photo in Nalco Laboratories)*

IN fighting fires or treating water, you want the men who are trained to do the job and who have the equipment to handle it.

The Nalco organization consists of highly trained, technical men with years of experience in finding the answers to thousands of industrial water treating problems. The Nalco laboratories are without question among the finest of their kind in the world. Here is your assurance that your job will be handled on a scientific basis with *permanent* satisfaction.

Call the Nalco Man today—he has answered many a 4-11 alarm put in by busy engineers faced with scale, corrosion, carryover, heat loss and reduced boiler capacity — he'll be there in a hurry.

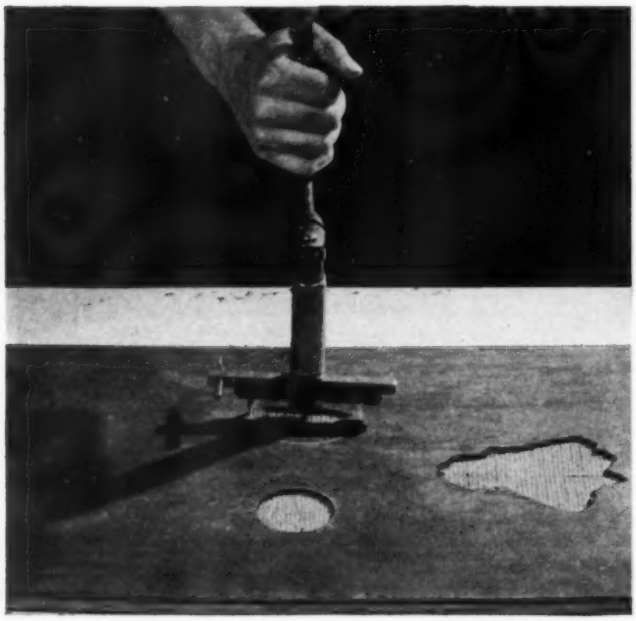
NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago, Illinois
Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

Nalco

..The Complete Water Treating Service*.
*Plant Survey *plus* Laboratory Research *plus* Controlled Chemicals *plus* Continual Check Reports.

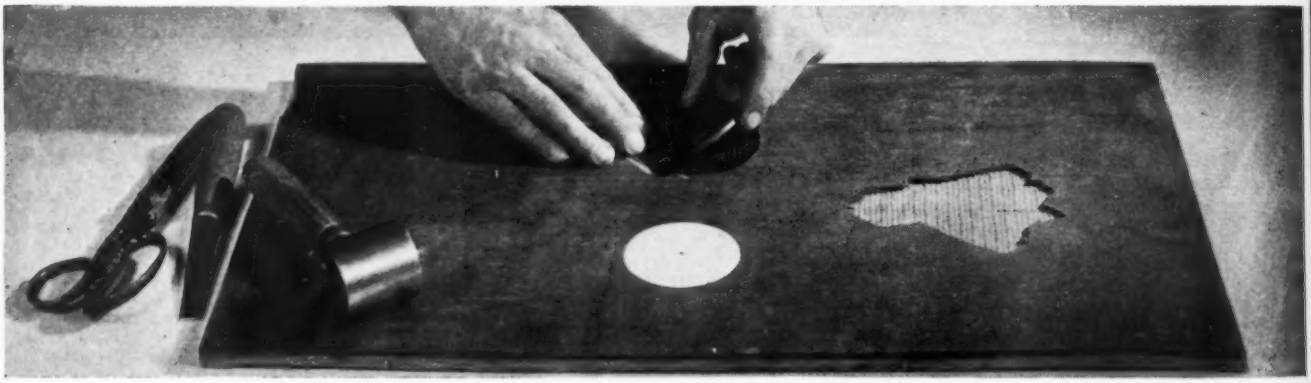
HOW TO REPAIR CONVEYOR BELTS

1 When the cover of a rubber conveyor belt is injured, encircle the injury with a gasket cutter. Cut through cover only and remove it. A little practice on a piece of old belt will give the feel when cutter blade touches fabric

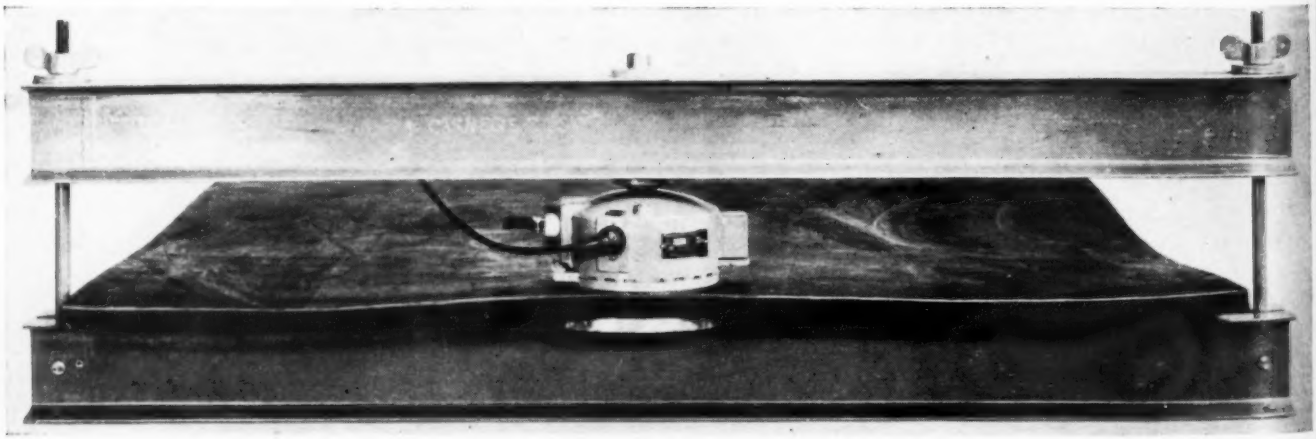


2 From a sheet of uncured rubber cut inserts for the areas removed from the belt cover. To cut these inserts set the gasket-cutter radius about 1/32 in. greater than when encircling the injury to allow for shrinkage

3 Before inserting the uncured cover stock into the cover cavity be sure that the fabric carcass is clean and dry. If fabric is wet, dry with warm air which can be supplied by a portable hair dryer. Brush nap of fabric with a wire brush and roughen edges of rubber with coarse emery. Apply two coats of good rubber cement, allowing each to dry thoroughly before filling the cavity with uncured rubber stock. *Photos by courtesy of B F Goodrich Co*



4 Fill cavity with layer of uncured rubber stock and roll in each layer to exclude all air from under the patch. Place piece of Holland cloth or linerette paper, about 2 in. larger than the patch, over the filled cavity to increase pressure on the repair when vulcanizer is applied. Apply vulcanizer and regulate to 287 F for about 30 min



An announcement

concerning

replacement parts for DE LA VERGNE DIESEL ENGINES

America's war production has created unprecedented demands for De La Vergne Diesel Engines. Our shops are working 24 hours a day, producing De La Vergnes to aid our armed forces to bring Victory at the earliest possible moment. Naturally, *new* diesel engines must come first. But in spite of this, we are doing everything in our power to produce replacement parts despite the difficulty in securing critical and other materials.

You can aid the war effort, yourself, other owners and us here at Baldwin by ordering *only those replacement parts you need* to keep your De La Vergne in operation. We will do our best to get you what you need, as quickly as we are permitted to make and ship parts.

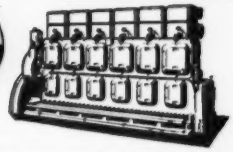
Your cooperation and patience will be sincerely appreciated, by us, our many customers and those units of the armed service which are using De La Vergne to speed Victory. Baldwin De La Vergne Sales Corp., a subsidiary of The Baldwin Locomotive Works, Philadelphia, Pa.

BALDWIN

De La Vergne

SALES CORP.

BLW THE BALDWIN GROUP



SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

ENGINEERS' BOOKSHELF

Air Conditioning

AIR CONDITIONING ANALYSIS (1943) *By William Goodman, The Trane Co, LaCrosse, Wis. Published by The Macmillan Co, 60 5th Ave, New York, N. Y. 455 pages, 6x9 in., illustrated, cloth cover. Price $6.00.*

This useful book deals entirely with the basic element of air conditioning—air—providing a comprehensive discussion of the fundamentals involved in the various air-condition changes which occur in practice. Mr Goodman's well-known ability to explain theoretical matters in simple terms finds full play in this text. To make for easier reading, all mathematical derivations are placed in appendices where they may be studied in detail if the reader so desires.

Believing that intelligent use of psychrometric charts simplifies analysis of air-conditioning processes, makes it easy to visualize these processes and facilitates quick graphical computations, the author discusses such charts in detail and works out many illustrative problems. Included are a complete set of tables of properties of humid air for all barometric pressures from 22 to 32 in. Hg as well as the usual tables for the standard pressure of 29.92 in. Hg. These tables should prove of considerable help for problems involving barometric conditions differing from the standard, frequently encountered in test work.

Any engineer desiring a firm grasp of the principles involved in changes of air condition or engaged in work where analysis of air-conditioning processes is a common problem, will find this book a valuable library addition.

Kinematics

APPLIED KINEMATICS—FOR STUDENTS AND MECHANICAL DESIGNERS. Second edition. 1943. *By J Harland Billings, Professor of Mechanical Engineering, Drexel Institute of Technology. 6x9 in., 320 pages, numerous drawings, photographs and diagrams. Published by D Van Nostrand Co, Inc, 250 Fourth Ave, New York, N. Y. Price $3.25.*

The first edition of this book was published in 1931. This second edition, substantially rewritten, considerably extends the treatment of some topics. Much illustrative problem material has been added and special attention is given to graphical methods. This book is thoroughly practical in approach. It plays up the principles of kinematics without extensive mathematics and shows the applications to innumerable commercial machines.

The book should be of definite interest to teachers and practicing engineers, as well as to students.

Energy

PRINCIPLES OF APPLIED ENERGY CONVERSION (1942) *By B G A Skrotzki, Consolidated Edison Co of N. Y. and W A Vopat, Cooper Union School of Engineering. Published by the Cooper Union Supply Store, 3rd Ave and 7th St, New York, N. Y. 236 pages, 8½x11 in., mimeographed, illustrated. Price $3.25 (2 vol).*

Written as a text for engineering students, this book should also prove of interest to practicing engineers desirous of learning more about the fundamental principles underlying the art of power-plant engineering.

Throughout, the authors emphasize principles and functions; details of design and construction of equipment are included only as necessary to illustrate essential principles. This concentration on essentials makes it possible to cover, in a relatively brief text, all phases of energy conversion—steam power, diesel- and gas-engine power and hydroelectric power.

The authors devote six of the 15 chapters to the economics of power generation and again concentrate on fundamentals and principles. These chapters include material on operating and fixed costs, load curves, plant selection, station performance and operation characteristics.

(*Continued on page* 156)

Changing your address soon? . . .

You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

Name.....

Old Address .....

.....

New Address.....

.....

New Co.....*Position*.....

Send to Circ. Dept. POWER, 330 W. 42nd St., New York, N.Y.

. . . if so, please fill in and return this coupon

Let-up IN SHUTDOWNS SPEEDS FOOD PRODUCTION

SOLNUS OILS

reduce Diesel "down-time". . . save 50% for food processor

Unfailing power must be maintained to turn the wheels of America's war industries faster. And here's how an eastern food processor achieved this goal!

Frequent shutdowns for repairs, sticky valves, and failure of the oil to hold up under running conditions were causing power interruptions and delaying production. So a lubrication expert was called — a Sun Oil "Doctor of Industry." He studied the operating conditions and recommended Solnus Heavy Medium Oil. The change was made. Now valves no longer stick, engine runs smoother, and there have been no forced shutdowns! Samples tested show that Solnus Oils hold up better . . . in fact, operating time between oil changes had been increased 50%. Oil and time are saved.

This is typical of the service Sun Oil Engineers and Solnus Oils offer industry today. Sun Engineers with their broad experience in solving all kinds of lubrication problems, can help you avoid production delays in your plant. Solnus Oils — low in carbon content, neutral in acidity, wholly distilled, and durable — can minimize wartime wear, and keep power output up.

Call in a Sun Doctor of Industry today to aid you in your battle for increased production. Write

SUN OIL COMPANY · *Philadelphia*

Sun Oil Company, Ltd., Toronto and Montreal, Canada

SUNOCO

SUN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AMERI*

POWER LINES

Personal notes, items of general interest, the latest from Washington:—all the news that is news in the power field

The nation's expenditures for munitions and war construction—planes, tanks, ships, guns, ammunition and other ordnance—will aggregate around **$157,000,000,000** from June 1940 through the end of 1943 if prices remain at current levels, the **Office of Price Administration** reveals. . . . Designated as **the most important safety meeting** ever undertaken in the New York area, the fourteenth annual convention of the **Greater New York Safety Council** will take place at the Pennsylvania Hotel March 23, 24, 25. While the conference will be marked by national features, there will be concentration on the needs of New York, New Jersey, Eastern Pennsylvania, Connecticut and Rhode Island.

Harry S Wheller has been elected president and general manager of **L J Wing Mfg Co,** New York, N. Y. Mr Wheller, who has been vice president since 1917, succeeds the late Alfred E Seelig as head of the company which was organized in 1883. Mr Wheller has been with the Wing organization for over 35 years.

American Engineering Co, Philadelphia, Pa. announces the appointment of the **American Equipment Co,** 5928 Second Blvd, Detroit, Mich. as their representatives for Hele-Shaw pumps in the state of Michigan. . . . **"The Blackmer Swinging Vane"** is the name of a new publication for the benefit of those who operate rotary pumps. The first issue presents a short story of the new Blackmer testing department and engineering laboratory, such news features as the

(*Continued on page* 188)

Food for thought and corrective action (as noted in the *Ohmite News*): since Pearl Harbor 85,000 persons in all have been killed in the United States by accidents and 7,700,000 injured. Ten companies are required to keep careless Americans with glass eyes and 25 more firms to supply crutches. Accidents in 1942 caused the loss of the staggering total of 410,000,000 man days of work.

✪ ✪ ✪

The North American Co announced Feb 3 the near completion of a large **emergency war construction program,** increasing the system's generating capacity by more than 30%. The system's expansion includes an increase of 185,000 kilowatts or 27% in the St Louis area by the **Union Electric Co** of Missouri and subsidiaries; 170,000 kilowatts or 33%, in the Cleveland area by the **Cleveland Electric Illuminating Co.;** 150,000 kilowatts or 59% in the Washington area by **Potomac Electric Power Co,** and 129,000 kilowatts or 24% in the Milwaukee area by **Wisconsin Electric Power Co** and subsidiaries.

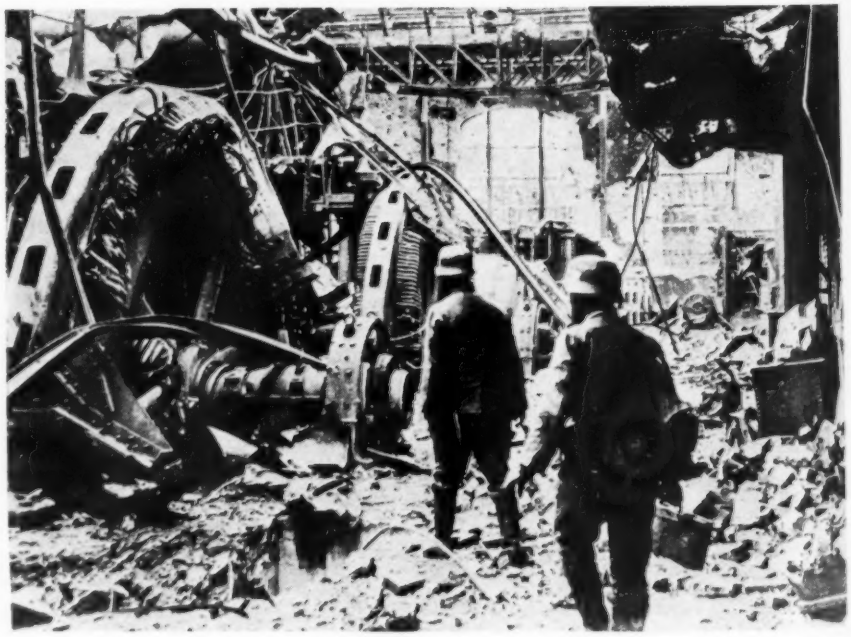
✪ ✪ ✪

An efficiency expert, according to *Link-Belt News,* is a man who knows less about your business than you do and gets paid more for telling you how to run it than you could possibly make out of it even if you ran it right instead of the way he told you to.

✪ ✪ ✪

A WPB simplification order — L252 — will reduce the number of types of gate, valve, globe, angle, cross and check valves from 4079 to 2504 for the duration to save an estimated 1900 tons of copper and 4340 tons of alloy steel annually. This is 9% of the copper and 27.5% of the steel normally used in valve production. Valves are classified in the order by **design, materials used, pressure and size.** Cross valves and brass or iron angle check valves are completely eliminated; pressure classes reduced from 18 to 12, sizes materially reduced. Use of brass, **regardless of pressure** is limited to sizes of two inches or less and the union bonnet rings and stuffing box packing nuts for brass valves are restricted to malleable iron or steel.

"MADE IN GERMANY", BLASTED IN STALINGRAD



German soldiers pick their way past the ruins of German-made diesel-driven generators in a war-blasted power-plant in Stalingrad, according to the caption accompanying this Nazi photo which reached New York from Lisbon *Press Association Inc.*

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Use "Character" Analysis!

PROBLEM: Selecting turbine oil is a major decision. For only an oil film stands between safe operation and possible destruction of the turbine. The oil must maintain a high chemical stability over a long period of service, because deposits resulting from oil oxidation may interfere with free oil flow through the bearing and governing apparatus. This will cause higher operating temperatures, rapid oxidation, even disastrous bearing failure.

ANSWER: The most dependable way to foretell what a turbine oil will do is to analyze its character. *What has it done for others over a long period?* Gargoyle D. T. E.'s are used in over 50% of U. S. A.'s major-sized turbines and have service records of over 120,000 hours in a single turbine. It has been *proved* that their chemical stability assures trouble-free lubrication. These oils are far-and-away your wisest and safest choice.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.— Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Capt Harold A Cunningham, Standard Oil Co of New Jersey, presents prize to (left) Ensign Leon Jackson (engine officer) and Ensign Antonio Ramirez (deck officer). These men "overcame the greatest obstacles in achieving their licenses"

Engineer Officers Feted

On January 29 over 600 newly commissioned Merchant Marine officers gathered in the Grand Ballroom of the Waldorf-Astoria Hotel in New York for their graduation dinner and dance. Most of these blue-uniformed new ensigns of the U S Maritime Service were in their twenties and thirties, but here and there one had a streak of gray in his hair. Every one had been to sea at least 12 months some time in his life. And every man had just topped off this required salt-water experience with a 4-months intensive course at the U S Maritime Service Officers School, Fort Trumbull, New London, Conn.

At Fort Trumbull the men were divided into two groups, according to background and interests. While a large group trained for deck officers, 232 candidates won their commissions as engineer officers. Many of these had seen their sea service as unlicensed engine-room personnel.

Under the leadership and instruction of experienced commissioned officers of the U S Naval Reserve and U S Maritime Service, the trainees brushed up on marine boilers, prime movers and auxiliaries—also on practical arithmetic, marine electricity, mechanical drawing, rules and regulations, first-aid, machine-shop practice and such drills as lifeboat, gas mask, safety lamp and oxygen apparatus.

Most of the trainees passed their examinations and were commissioned as Ensigns (Third Assistant Engineer officers) in the Merchant Marine just before the dinner-dance.

After dinner Comdr John D Bosler, USNR, Supt of the USMS Officers School, congratulated the new engineer officers. Comdr H H Dreany, assistant commandant, USMS, read greetings from Capt Edward Macauley, USN (Retired), deputy administrator, War Shipping Administration.

Toastmaster Lieut Comdr William C Ash, USMS, and executive officer of the School, congratulated the graduates on their high standards.

Many prizes were awarded. Ensign Frank M Orton received the American Merchant Marine Institute prize for student with highest standing, and John Armstrong, Jr, the U S Lines Co prize for Excellence in Navigation.

Sverre Hetland, veteran of 20 years' seafaring and of one torpedo sinking, won the Seas Shipping Co prize for Seamanship, and John T Bedell the A Dubois and Son prize for Cargo Handling and Stowage. V C McNaughton won the Marine Transport Lines, Inc, prize for Signalling, and Alex S Meloy the Socony-Vacuum Oil Co prize which is awarded for Excellence in Machine Shop Work.

Standard Oil Co of New Jersey Marine Department presented special awards to the "Deck" and "Engine Room" graduates who had overcome the greatest obstacles to win their licenses—Leon Jackson for the Engine Room and Antonio Ramirez for the Deck.

Of special interest to power men were the awards to Everett B Eisler and Frederick G Muhleisen. Ensign Eisler won the Moore-McCormack Lines prize for Excellence in Diesel Engineering, and Ensign Muhleisen the Keystone Tankship Corp prize for Excellence in Marine Steam Engines, Boilers and Auxiliaries.

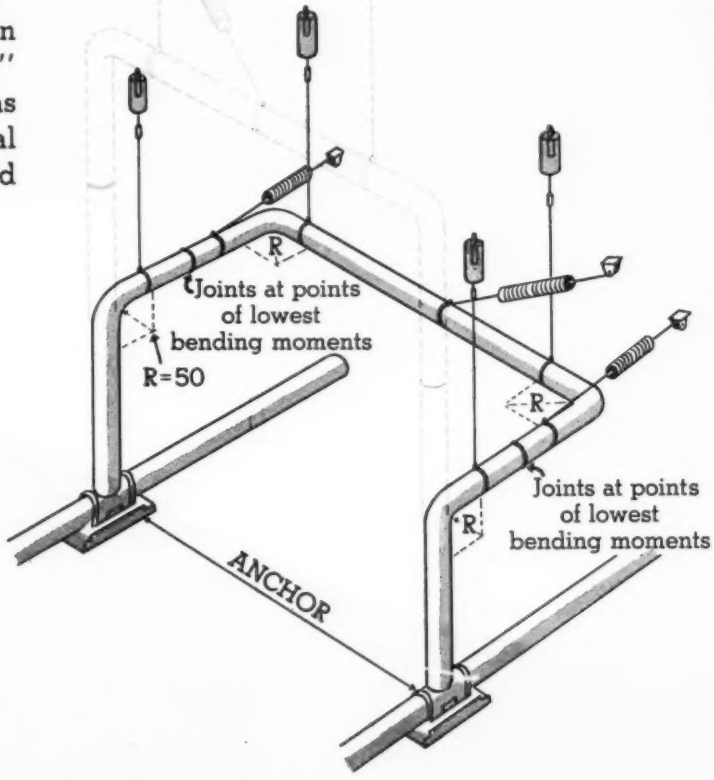
Note: For discussion of the Ft Trumbull School, the crisis in marine engineer manpower, etc., see page 64 and editorial on page 65—Editor

More than 600 newly commissioned marine officers and their ladies at the Waldorf Astoria, New York, are led in the singing of "Auld Lang Syne" by the commanding officers of the U. S. Maritime Service Officers Training School of Fort Trumbull, New London, Conn. Left to right: Comdr H H Dreany, assistant commandant, U. S. Maritime Service; Lieut D G Poyntz, USMC (engineer instructor); Comdr John D Bosler, USNR, supt, USMS Officers School, Lieut Comdr Wm C Ash, USMS, executive officer, USMS Officer School

USMS photos by Owen

THE SCIENTIFIC APPROACH TO YOUR PIPING PROBLEMS

One example of "Scientific Approach to Piping Problems," illustrates a suggestion for a two plane "U" bend as a simplified as well as an economical design for low head room conditions.



Spring assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a remarkably neat appearance.

Functional Hangers and Vibration Eliminators permit unrestricted line movement. Exclusive features allow swivel action in all directions and eliminate metal fatigue.

POWER PIPING DIVISION presents the ultimate in ENGINEERING • PREFABRICATION • ERECTION

- **Engineering**
- **Prefabrication**
- **Erection**

The employment of FLEX-ANAL CHARTS* enabling engineers to simplify and quickly arrive at an economical design.

All sub-assemblies are completed under rigid engineering control. This results in a negligible amount of field welding and simplifies erection.

Highly developed procedures employed provide the last word in economical erection. The use of Functional Hangers and Vibration Eliminators adequately control the behavior of your piping system.

A

* The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a request on your business letterhead.

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

Prevent Valve Failure

A neglected leak in the packing box of the valve illustrated corroded the spindle so badly it had to be replaced.

The crusted scale formation (1) indicates that the leak was apparent for a considerable length of time. It is also evident that the gland has been tightened to the limit (2) by someone who evidently believed he was checking the leak by compressing the packing. Instead, the packing was simply jammed into a hard, dry mass.

While the spindle was being replaced, it was necessary to close the main steam line and interrupt production in a plant buzzing with war work.

A properly trained maintenance worker would have first tried to stop the leak by a few turns on the gland to compress the packing. When this failed, he would have repacked the box. The leak would have been eliminated, the spindle saved, and the production slowdown avoided.

Waste of production hours through preventable valve failure is inexcusable today, since delay in the delivery of war materiel may eventually spell defeat for our armed forces on some distant battle field. Equally serious is the waste of critical metals by needless destruction of valve parts. Such waste can be effectively controlled by an adequate program of valve conservation.

Make sure your valves are inspected regularly, systematically. Repair or replace worn parts before a valve destroys itself. Instruct maintenance workers thoroughly, and supply them with the necessary parts and tools. Select valves for new installations carefully; install them properly.

Jenkins Engineers will provide any assistance you need for improving your system of valve conservation upon receipt of details of present valve problems.

Army-Navy "E" Pennant, awarded to Jenkins Bros. for high achievement in the production of war equipment.

Jenkins Bros., 80 White St., New York, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill. Jenkins Bros, Ltd., Montreal; London, England.

JENKINS VALVES

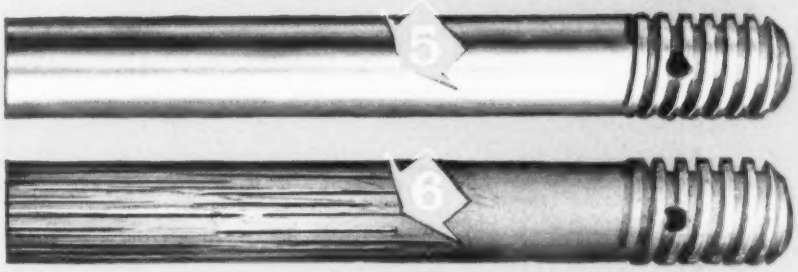
before it starts!

PACKING BOX LEAKS . . . . COMMON CAUSE OF VALVE TROUBLE . . . ARE EASILY CORRECTED BY PROPER MAINTENANCE . . . . . .

Frequent inspection will reveal the continuous, tell-tale drip where the stem enters the packing box, which indicates faulty packing. Make certain that the packing box is made tight by applying ordinary effort to the gland nuts. Then if leak continues it is usually necessary to repack the valve.

When repacking, clean out all the old packing, and replace it completely with new. Be sure to use the proper type of packing recommended by the valve manufacturer. Leaks often result from the use of the wrong packing.

If valves are used infrequently, or if internal conditions are unfavorable, it is advisable to keep a live load on the packing at all times. Steel springs with two or three coils, installed between the packing nuts and gland (see 3), will keep packing compressed and compensate for varying conditions. It will also minimize the maintenance necessary for this type of valve.



Packing box leaks are just as troublesome in small valves as in large. Excessive tightening of the packing nut will *not* remedy the condition when repacking is necessary. The packing nut (4) on the Bronze Gate Valve (left) was split and ruined when it was jammed against the gland by a heavy handed worker.

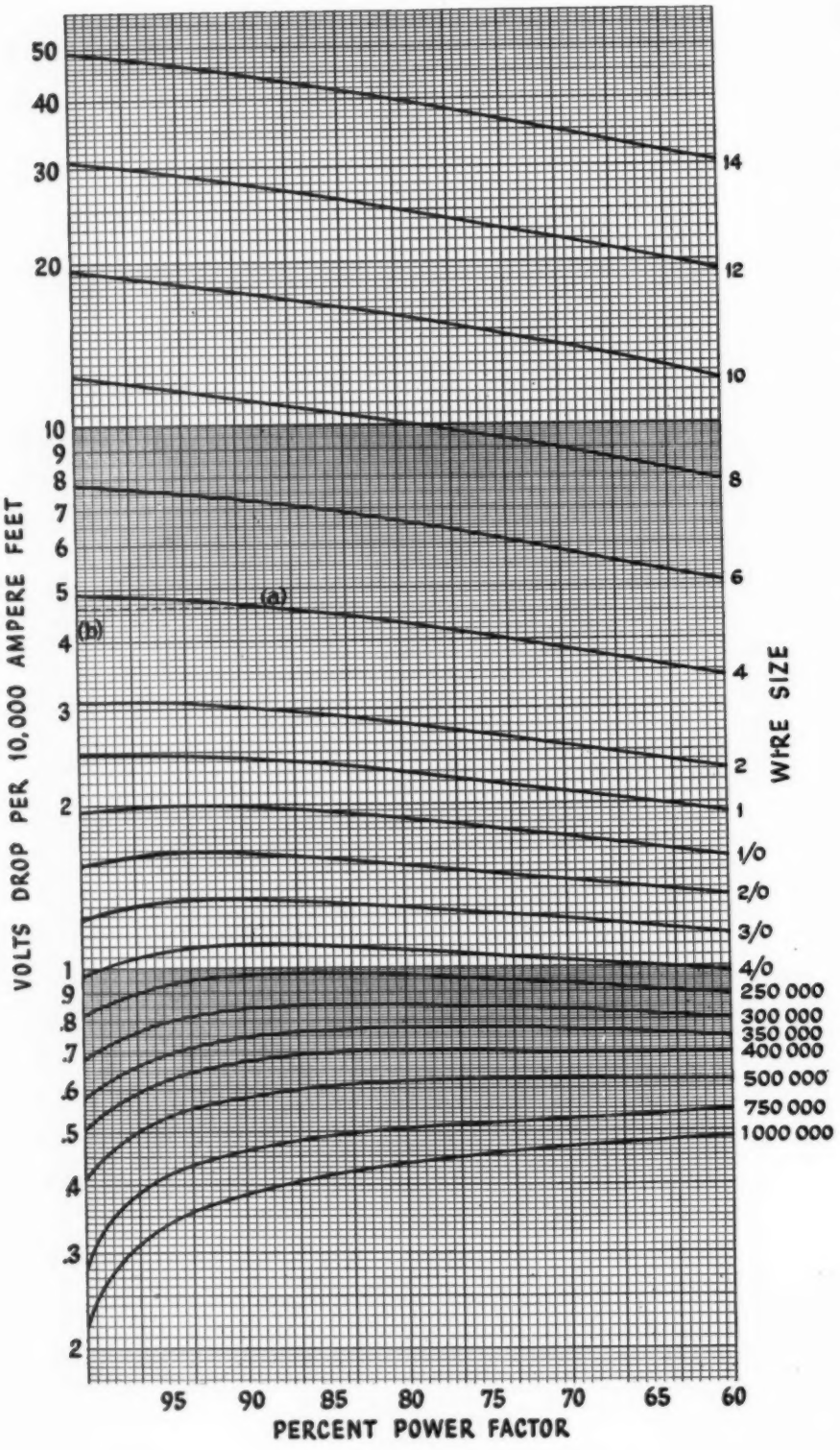
The condition of the spindle is of material importance in preventing leaks. It should be clean and smooth like (5), not scratched and scored like (6). Smooth spindles preserve the life of the packing. They also permit the transmission of full closing effort to the seat without loss in friction at the packing box.

For every industrial, engineering, marine and power plant service

BRONZE ★ IRON ★ STEEL

Number 127

Voltage Drop for 3-Phase Circuits



To FIND THE VOLTAGE DROP per 10,000 amp-ft for 3-phase 60-cycle circuits with conductors closely spaced in conduit and operating at 49 C, first determine the power factor of the load and the actual or estimated wire size. From average power factor at bottom of chart, follow vertically to wire-size curve and then horizontally to left to find voltage drop per 10,000 amp-ft. From kilowatt load and power factor, calculate amperes per conductor. Multiply amperes per conductor by conduit run to find ampere-feet for actual circuit.

Chart can be used to find allowable load by reverse process. For example, what load can be carried on a circuit of No. 4 conductors if connected to a 3-phase 4-wire 120/208-v 60-cycle supply without exceeding a 4-v drop in a run of 150 ft? The average power factor is 90%.

Solution: Follow the 90% power-factor line vertically until it meets the line representing No. 4 conductors (point *a*). Follow horizontally to the left to read 4.6-v drop (point *b*) for 10,000 amp-ft. Since a drop of 4-v is the desired maximum, the total allowable ampere-feet is

$$\frac{4}{4.6} \times 10{,}000 = 8700$$

and to find the current, divide by the run, 150 ft

$$\frac{8700 \text{ amp.-ft.}}{150 \text{ ft.}} = 58 \text{ amp.}$$

and then determine the total load as follows

$$\frac{58 \text{ amp} \times 120^{a} \times 3^{*} \times 0.90 \text{ pf}}{1000 \text{ (watts to kilowatts)}} = 18.8 \text{ kw}$$

* *For 3-phase*

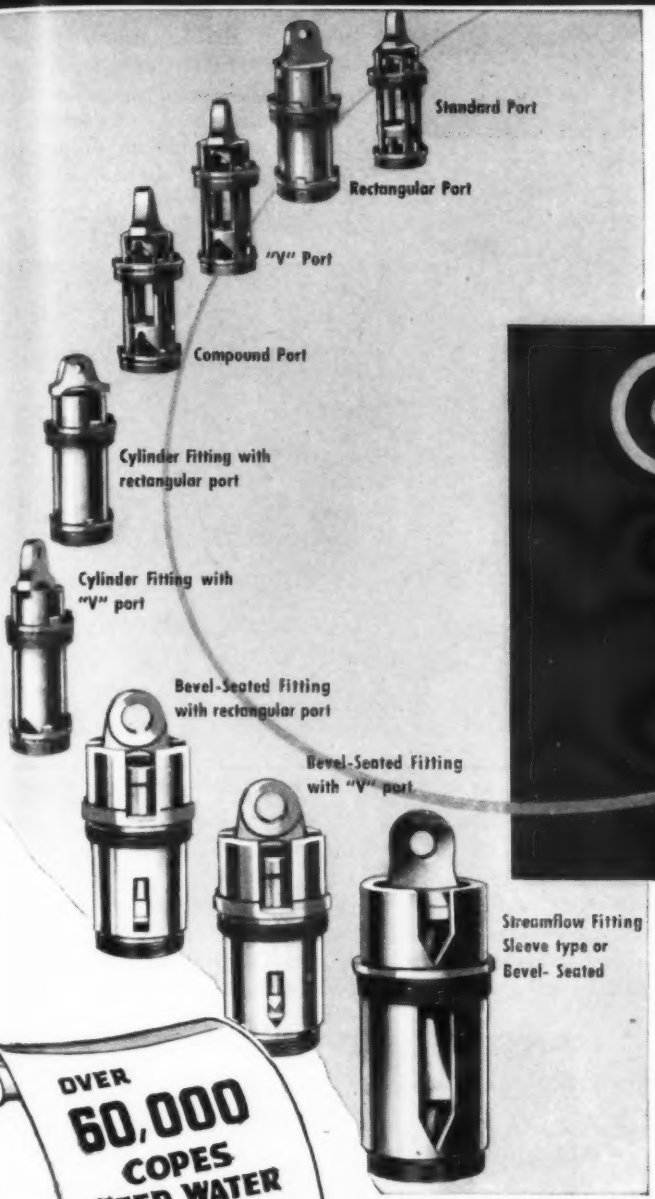
With a little experience, this chart can be used for all types of voltage drop problems. For short runs, however, care should be exercised that the conductor size selected is not smaller than that required for carrying a given current flow as limited by the National Electrical Code.

Courtesy National Electric Products Corp.

© POWER

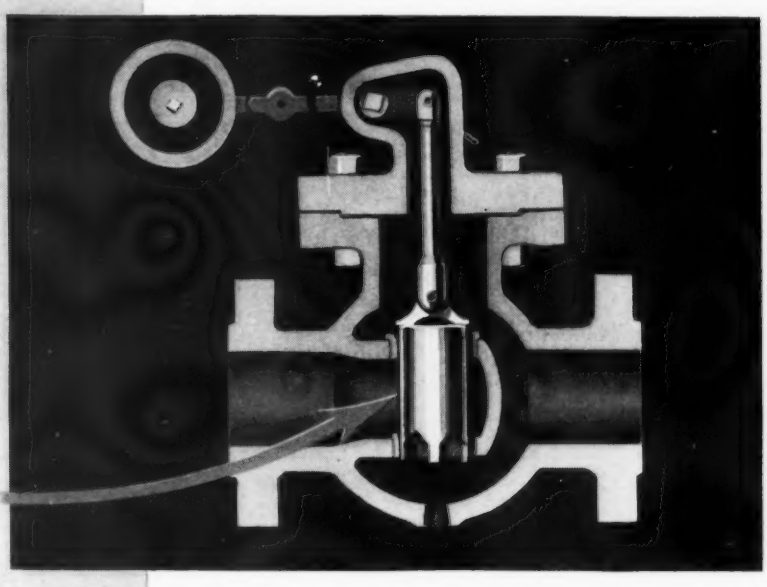
NO TWO BOILERS ALIKE

THAT'S WHY THE COPES BI-VALVE IS DESIGNED FOR THE BOILER IT SERVES



THE BI-Valve is as common to COPES Feed Water Regulation as is the familiar Thermostat. With 30 years of constant improvement and simplification, checked in over 60,000 applications, the BI-Valve is built to meet all boiler feed water requirements.

Out of several hundred exhaustive tests with as many different types of inner valves, we have learned which size of ports are necessary to give the proper imput to your boilers. They are tailored to meet specific operating conditions.



These "made to order" inner valves are one of the reasons for superior COPES performance—the closest relation between water imput and steam output—smoother charts.

Let COPES show you how to get the most out of your boilers.

NORTHERN EQUIPMENT COMPANY

1221 GROVE DRIVE • ERIE, PENNSYLVANIA

Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls Reducing Valves and Desuperheaters

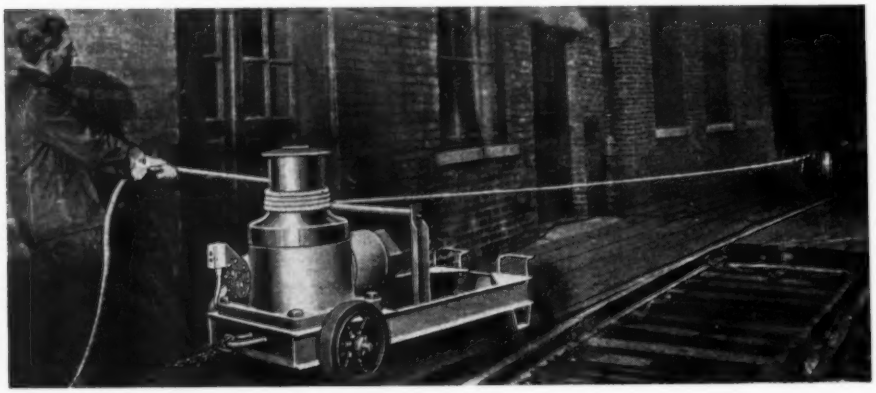
BRANCH PLANTS IN CANADA, ENGLAND **REPRESENTATIVES EVERYWHERE**

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOW-MATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

WHAT'S NEW IN PLANT EQUIPMENT



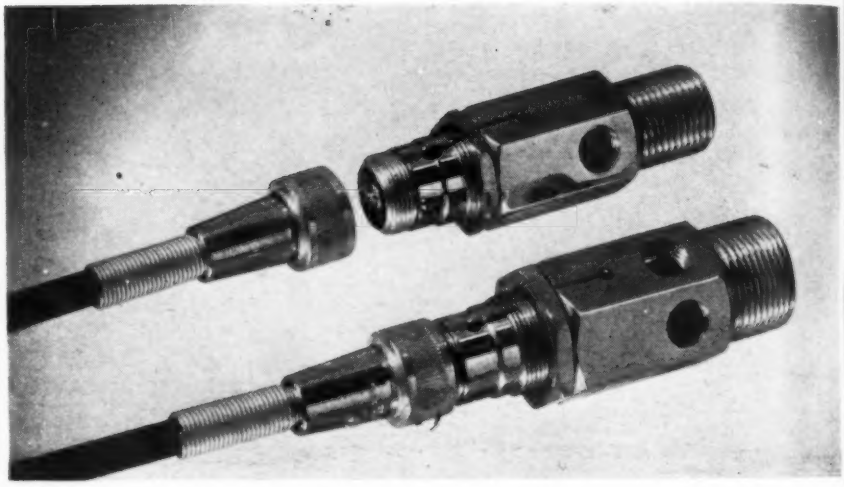
Car Spotters

LINE OF MOTORIZED electric car spotters, heretofore furnished for only stationary mounting, now available also in portable form as shown in illustration. Spotter is so balanced on a channel-iron frame that one man can lift one end and roll the unit to any desired location. Operator need but anchor the frame with a chain as illustrated, plug electric cord into nearest power outlet, hook one end of haulage cable to car or object to be moved, wrap the other end around capstan, turn on the motor, and feed away the cable while the machine does the actual pulling. Standard machine can be used for spotting railroad coal cars, etc. *Link-Belt Co, 307 N Michigan Ave, Chicago, Ill.*

Pressure Pickup

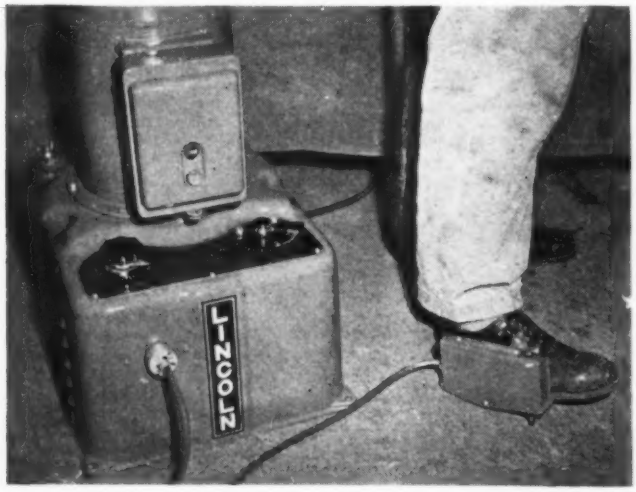
ELECTRO PRESSURE and detonation pickups are used with diesel and gas engines, pumps, compressors and similar mechanisms to record instantaneous pressures and other phenomena occurring within the firing or compression chambers. Unit consists of a magnetic-type pickup having a diaphragm, exposed to the explosion or pressure forces within the cylinder, the vibration of diaphragm producing magnetic flux variations in a coil assembly which is said to provide an output voltage having identical characteristics to the

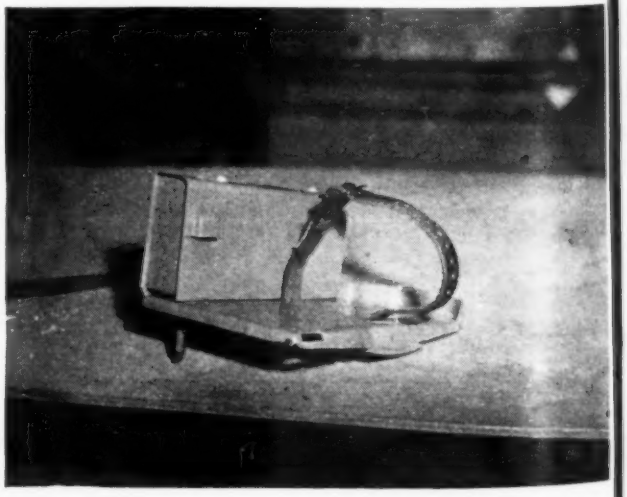
(*Continued on page* 172)



Arc Welding Control

LINCONTROL ARC-WELDING CONTROL enables the welder to speed up his work and do a more accurate job, according to company. Control is strapped to the welder's foot and enables him to move about with it freely. With the control strapped to his foot, see illustration, the welding operator merely presses down on the pedal which moves a pin to operate a current control. As he exerts pressure he increases the current. This permits accurate control over the welding arc. Because the operator has complete control, he can adjust the arc at any time without changing his position. The control is designed for the Lincoln "Shield Arc Junior" welder. *Lincoln Electric Co, 12818 Coit Rd, Cleveland, Ohio.*





ARE *Critical Materials* DELAYING YOUR PIPING JOBS?

Short-Cuts to Faster Piping Jobs
HELPS IN MEETING PIPING MATERIAL SHORTAGES
FOR SPECIFIERS
PLEASE NOTE AND PASS ON
POST ON SHOP BULLETIN BOARD
..FOR PIPEFITTERS

New "PIPING POINTERS" Give Helpful Ideas

SHORTAGES of materials challenge the ingenuity of piping men. To speed installations and keep pipe lines flowing, it's up to them to make safe and practical substitutions—and devise short-cuts at every turn!

Just printed, Crane "Piping Pointers" Bulletin No. 6 is ready for you with valuable suggestions for using alternate materials. It gives handy hints for making emergency installations. It will help your men get jobs done faster—help you prevent delays in war production.

Sent Free on Request—"Piping Pointers" are designed to aid you in meeting three wartime responsibilities: (1) keeping pipe lines at peak efficiency, (2) training new maintenance workers, (3) conserving critical metals. They're based on Crane Co.'s 87-year experience in flow control engineering. Copies of Bulletin No. 6—as many as you need—are yours for the asking. Call your Crane Representative, or write to: **Crane Co., 836 South Michigan Ave., Chicago, Illinois**

CRANE VALVES

We Can Be Brave . . .

"Some eulogies to America get lyrical about the vast mountains, the broad plains, the verdant valleys, the gleaming cities, the aroma of home-cooking on a moon-drenched Autumn night. But other countries have mountains and plains, and valleys, and cities, and home-cooking—have had them all longer than we have. *The thing is, the people who built America have done something with the tools at hand.* They've alloyed their steel with sweat. And with brains. And with courage. They have built their own freedom . . . a freedom worth fighting for."

That closing paragraph in the 100th anniversary book of Ryerson Steel Co is one of the best answers I've found to the Axis claim that America has gone soft—if we need any other answer than our performance during the past year.

The American pioneering spirit has never died—it has only been converted from building new lands to building better living. Any system of free enterprise requires a fight for survival; only the opponents are different. Instead of the elements and the wild beasts, they are competitive industries and plants. The weapons are the slide rule and adding machine instead of the gun and the axe. Penalties for failure and rewards for success are still the same.

Every time you've figured out a lever arrangement that saves muscle, or a gage-reading setup that saves steps, you've been pioneering just as surely as was Daniel Boone. You've been striving to make your own plant more nearly perfect. Perfection, after all, is made up of little things, but perfection itself is not a little thing. It takes pioneering and initiative to achieve. It takes bravery too—to stand up under the gibes of others who want to keep on doing the job grandfather's way.

Perhaps the comparison between the obvious bravery of the pioneers and the bravery of the "ordinary" man of today is best expressed by the self-communion of the little mongrel pup, who alone had the downright *guts* to face the region's biggest bear. Said he to himself, according to William Faulkner:

"I can't be dangerous, because there's nothing much smaller than I am.

I can't be fierce, because men would call it just noise.

I can't be humble, because I'm too close to the ground to bow.

I can't be proud, because I'm not even big enough to cast a shadow.

I can't even go to heaven because men have already decided that I don't possess an immortal soul.

So all I can be is brave. But it's all right. I can be that, even if men still call it just noise."

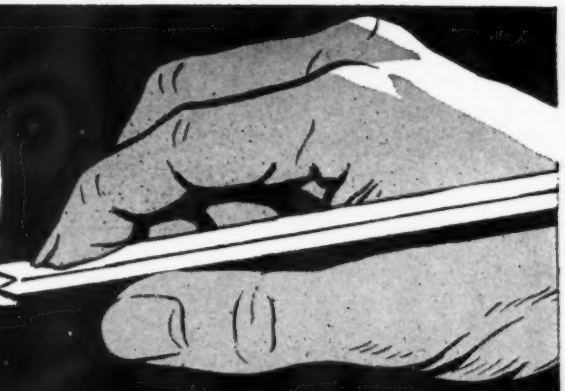
That's a code plain enough for any of us to follow. We may not fight on some foreign battlefield; we may not even be doing a job that obviously helps others fight. But in producing power, and heat, and steam for the work that must be done at home, we can still use the guts that made America what it is. We can still be brave.

George Edwards

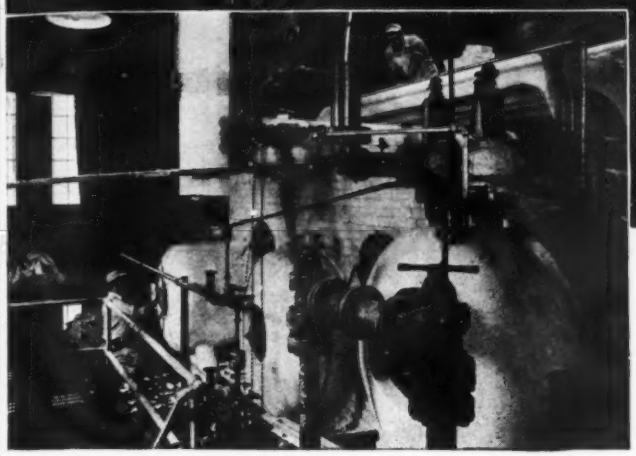
Engineer

STEAM PIPE INSULATION

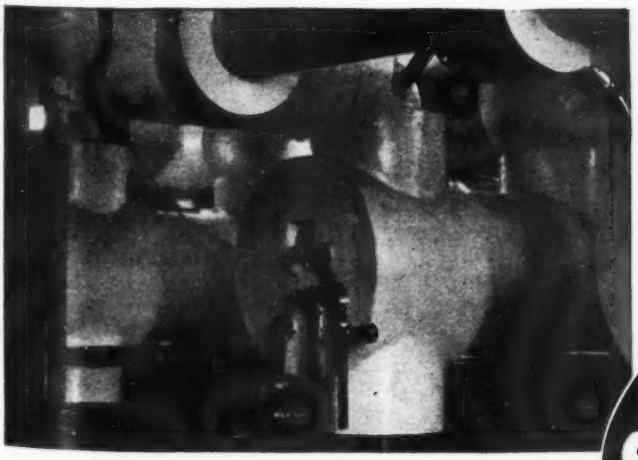
J-M 85% Magnesia



The Most Widely Used Specification in Power Plant Insulation for More Than 50 Years



FOR PIPE COVERING . . . J-M 85% Magnesia Pipe Insulation is furnished in 3-ft. sections or segments in the following thicknesses: Standard, 1½", 2", 2½", Double Standard and 3" (Double Layer). Often used as a second layer, outside of J-M Superex, where pipe temperatures are above 600° F.



IN BLOCK FORM . . . J-M 85% Magnesia Blocks are furnished 3"x18", 6"x36", 12"x36", in thicknesses of 1" to 4". Weight, about 1.4 lb. per sq. ft., per 1" thick.

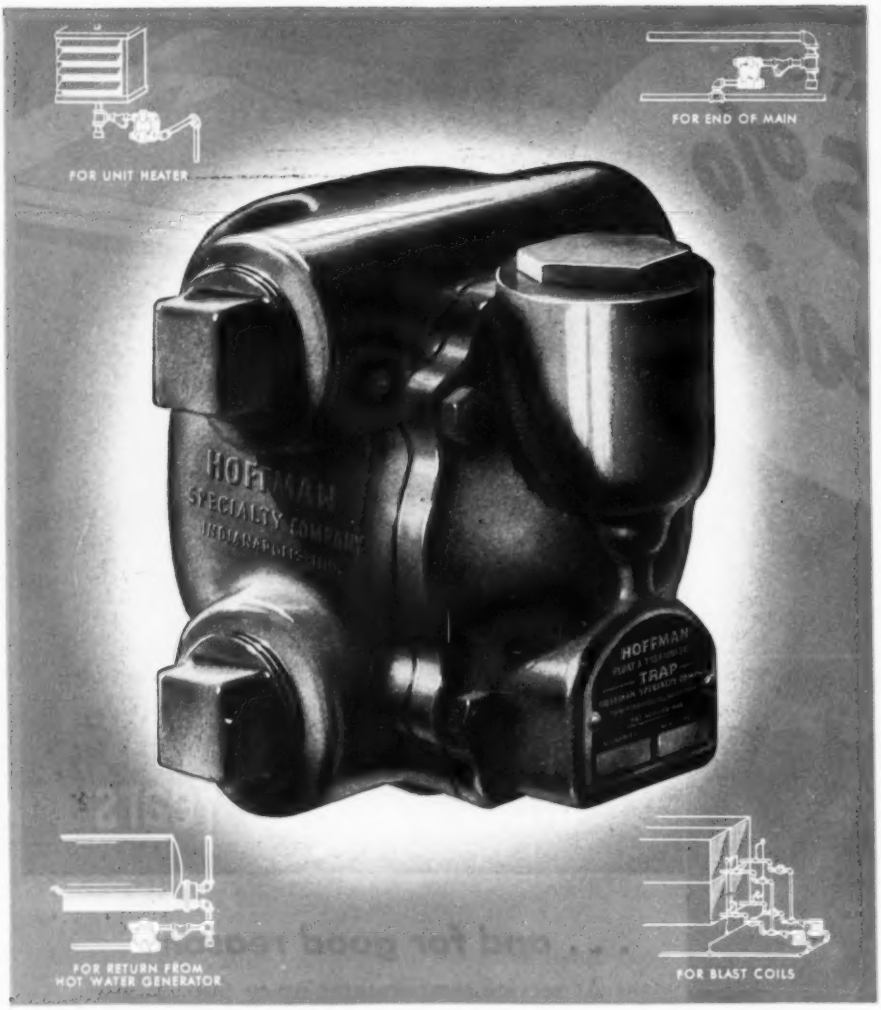
. . . and for good reasons

At service temperatures up to 600° F., no insulation delivers more thoroughly satisfactory performance than J-M 85% Magnesia. That's a fact that's been proved time and again in power plants of every type. Light in weight, readily cut and fitted, J-M 85% Magnesia is easy to install. On the job, it provides ample mechanical strength, long life and high insulating efficiency. Engineers agree that, wherever used, J-M 85% Magnesia assures permanently economical service.

Consult your nearest J-M District Office today about your Magnesia requirements, or write direct to Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE
INDUSTRIAL INSULATIONS
For every temperature . . . for every service condition

JOHNS-MANVILLE JM PRODUCTS



Short of Fuel?

YOU CAN MAKE UP THE DIFFERENCE WITH HOFFMAN *FUEL-STRETCHING* TRAPS AT THE POINTS SHOWN ABOVE

Serious shortages have awakened commercial and industrial users of fuel to the immediate need for complete efficiency in their steam heating or processing systems. Fortunately, in many instances this can be speedily accomplished by simple, inexpensive modernizing.

If *you* are wondering how to make fuel ends meet, here's what others are doing: First, checking carefully all heating equipment and replacing those units which are not giving full service. Second, installing additional valves, traps or pumps where good steam-plant engineering indicates their need.

Reports on such modernized systems show that satisfactory steam production can be maintained even on a reduced fuel supply. The diagrams above show a few locations where traps should be installed for best steam conservation . . . or replaced if in poor operating condition.

The acceptance given Hoffman Steam Specialties by both our government and private industry warrants your investigation when bringing your own plant up to top efficiency. Hoffman field engineers are available for consultation at all times. Write for literature.

Hoffman Specialty Co., 1001 York St., Dept. D-3. Indianapolis, Ind.

EVERY PART RENEWABLE

HOFFMAN
CONTROLLED HEATING
STEAM HOT WATER

Marine Engineer

(*Continued from page 66*)

examination for Third Assistant Engineer.

At sea as a Junior Engineer, he receives basic wages of $155–185 per month plus overtime, plus war-zone voyage bonuses of 40 to 100% of basic wage, plus certain port bonuses for each stopover ranging from $40 to $125. Third Assistant Engineer's basic wage ranges from $165 to $224, Seconds get from $180 to $253, and Firsts from $200 to $316. Chief Engineers command from $285 to $460 with bonuses but without overtime.

Certain other provisions (previously detailed in POWER) are available to marine officers. War-risk insurance in the amount of $5000 is paid by the employer. Additional insurance can be purchased from private concerns at $50 per thousand over standard premiums. Any part of an engineer's wages can be allotted to members of his family. He is also entitled to medical, hospital and normal dental care at a Public Health Service Unit.

Under this program, stationary engineers will be able to utilize skill acquired ashore in positions that will contribute directly to winning the war. They have no guarantee of a long and comfortable life, but constantly improved equipment, new ships and new safety devices, more guns and escort vessels, all combine to make life at sea as safe and happy as possible in wartime.

Editor's Note: If you are a qualified licensed stationary engineer with at least two years' experience you believe will qualify you for marine service, write details of your experience to the nearest RMO office listed in the chart or show up personally at nearest branch of U. S. Employment Service. It saves time and correspondence if you have your own doctor give you a thorough-going once-over and inclose his report.

Watch Weakest Link

(*Continued from page 67*)

several hours the oil will soak out and discolor the white coating if a crack exists.

Small dents similar to peen marks on the surface of links, or even a bright surface, usually indicate that a chain

An air raid warden for STEAM-USING UNITS

The Anderson Thermal Air Eliminator on Super-Silvertops is a steam trap air raid warden whose job is to remove air from any type of steam-using device that needs instant heat. It is "on duty" the minute steam is turned on. Located on the side of the bucket, the snap-action air eliminator is wide open and the pressure of that steam forces the air out the exhaust in an instant. Then the eliminator disc snaps shut over the exhaust preventing steam loss. With the air removed, hot dry steam is immediately supplied and heating begins at once—not hours later. Once the air is removed, the Anderson Super-Silvertop keeps the unit free of condensate and entrained air for the balance of the heating cycle.

Super-Silvertop Steam Traps with Thermal Air Eliminator are recommended for steam coils at pressures up to 150 pounds—unit heaters at low pressure—steam jackets or chests where volume is large, or on any unit demanding instant heat. Write today for the book "How To Choose A Steam Trap" that explains Snap-action Thermal Air Elimination in detail.

THE V. D. ANDERSON CO.
1934 West 96th St. • Cleveland, Ohio

Super-Silvertop STEAM TRAPS

★ Simple
★ Rugged
★ Reliable
★ Made in U. S. A.

. . . the JONES heavy duty HAND TACHOMETER

Here is a rugged American-built Hand Tachometer . . . available for delivery, in accordance with your priority rating.

We suggest the Jones Heavy Duty Hand Tachometer for indicating rpm and surface speeds of all types of machinery in which the moving parts are readily accessible.* It is built to "stand the gaff" and maintain accuracy in hard, everyday service. Single and triple range models up to 12,000 rpm. Instruments are furnished complete with carrying case, including extra tips. Rubber-tired wheel for measuring surface speeds available at slight additional cost.

* Where moving parts are not readily accessible, as in turbines, centrifugal pumps and other totally enclosed machines, and also for measuring vibrations per minute, we recommend our Frahm Vibrating-Reed Tachometers. Ask for Bulletin 1590-P.

Write for new descriptive Bulletin 1710-P

James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

has been work hardened or fatigued. When this condition is evident, anneal or normalize the chain. Remove links that have been crushed or bent out of shape.

Check up on the stretch of a chain. This requires an accurate measure of new chain between definite points, such as bearing of ring and hook on a sling, or center-punch marks at 3-ft intervals on a long chain. If the elongation approaches 1 in. in 3 ft, the chain should be annealed. Stretch greater than this warrants condemning the chain as does visual evidence that the links have been distorted enough to bind on each other.

The hook should be designed as the weakest part of a sling. It seldom if ever breaks, but fails by straightening out and slowly releasing the load. Load on a hook may approach 300% of rated capacity before serious distortion takes place, as in Fig. 2. The inside of a hook is usually an arc of a perfect circle; any deviation from this shape indicates that a hook has been severely overloaded. If it has spread or opened up as in No. 3, discard it at once. Reforging and annealing are permitted only if deformation has not exceeded that of No. 2. Inspect the neck of the hook, also, for indications of strain, particularly if the fillets at shoulders have a small radius.

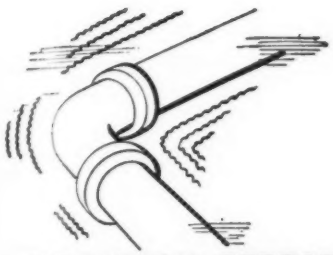
Under no circumstances should an inspector "okay" a chain that has been lengthened by bolting two sections together. Neither should he allow an eye to be made by looping a chain back on itself and bolting together. Nor should tying chains into knots to shorten them be permitted. All these tricks cause excessive bending stresses in the links and reduce the safe working load that can be applied to a chain.

Adapting Turbine

(*Continued from page* 70)

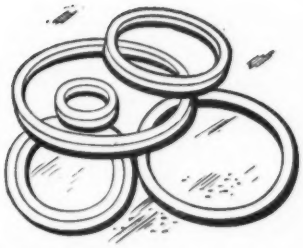
ernor, thus artifically loading the plunger against the retaining spring and causing the governor to trip at rated speed. The governor trip test plunger, on the outboard end of the high-pressure turbine is normally protected by an easily removable cover.

Whenever the throttle trip valve is closed by action of any of the several governors, the steam admission valves in the high-pressure steam chest also close and the crossover bleeder valve opens. Fundamentally, operation of any of the tripping devices unlatches the throttle trip valve and opens the



VIBRATION EFFECTS

You need never worry about vibration or strain loosening a *welded* joint.



GASKET CHANGES

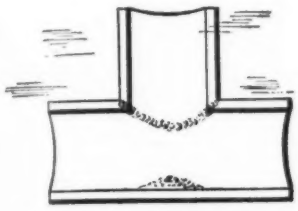
Fewer flanged joints mean less gaskets—save materials and time.

How to eliminate these piping troubles that hamper war work:

Weld with

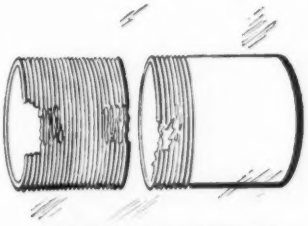
TUBE-TURN

WELDING FITTINGS



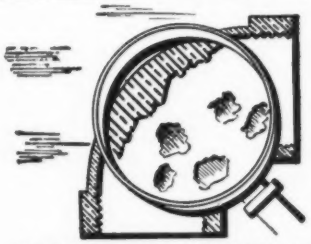
SLAG ACCUMULATION

Butt welds with Tube-Turn fittings virtually eliminate danger of slag.



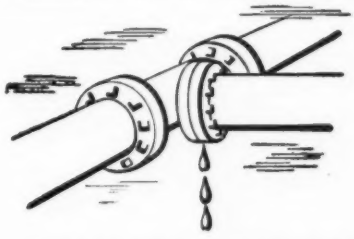
WORN THREADS

Threading thins and weakens metal—causes failures.



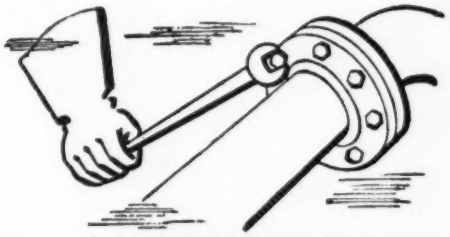
RAPID CORROSION

Tube-Turn fittings resist corrosion because of better metal structure.



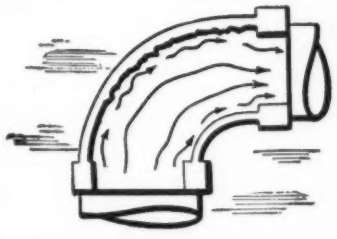
LEAKAGE REPAIRS

No chance of loose connections or leaks with Tube-Turn fittings.



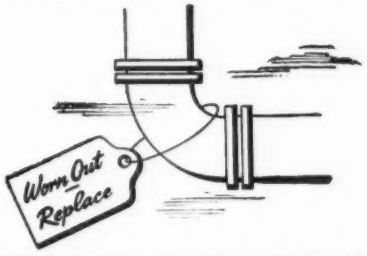
LOOSENED BOLTS

The more welding fittings used, the fewer bolts there are to tighten.



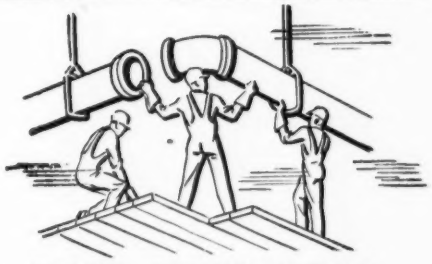
INEFFICIENT FLOW

Easy sweeping radius and no offsets inside mean less pressure loss.



FITTING REPLACEMENT

There's far less time loss or replacement expense with Tube-Turn welding fittings.



SLOW INSTALLATION

Tube-Turn fittings line up perfectly; allow fast, simple, easy butt welding.

NO. 3 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS AND STILL THE BEST

TUBE-TURN

TRADE MARK

Welding Fittings and Flanges

Tube Turns (Inc.) Louisville, Ky. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. *Distributors in principal cities.*

Cuts your gasket costs in half

The most remarkable tool ever invented

Write for booklet

THE ALLPAX GASKET CUTTER

Manufactured by

THE ALLPAX COMPANY, INC.

Distributors everywhere ***Mamaroneck, N. Y.***

governor oil system to drain. With oil pressure relieved, the several piston-operated valves respond to the action of mechanical springs. Thus, a spring moves the piston in the power cylinder to close the steam-admission valves and the crossover bleed-control spring moves its valve to full-open position.

The high-pressure element is specially designed for the higher pressure and temperature. The first six turbine wheels are machined from a solid forging, integrally with the shaft, to eliminate trouble from unequal expansion of shaft and wheels. Outboard end of the high-pressure turbine rests upon a pedestal which slides in lubricated guides.

Velocity compounding in the first-stage wheel utilizes efficiently a large pressure drop in the first-stage nozzles. Advantages of velocity compounding lie in reducing length of machine through using fewer stages than would otherwise be needed and also lowering pressure against which the high-pressure end of shaft must be sealed.

Shaft Packing

Shaft packing consists of metal labyrinths followed by carbon packing rings. A metal labyrinth and carbon rings are used also in the exhaust-end packing box of the high-pressure turbine. The low-pressure turbine packing box contains only carbon rings. Steam leakage from the packings under pressure is normally sufficient to seal the low-pressure carbons, but in starting the machine live steam at 10 psi g is required for sealing. Interstage leakage within the turbine is resisted by horizontally-split metal seal rings of the labyrinth type carried by the diaphragms to form close radial clearances around the shaft.

Output of the rebuilt unit is delivered to the dc auxiliary bus with the output of the low-pressure dc units and motor-generators. Since the rebuilt machine is the most efficient of the several dc sources supplying the common pool, it is called upon for more than its normal share of output. Besides its better economy on condensing operation, the unit is particularly advantageous in winter because its positive extraction control assures a supply of bleed steam for building heating.

Operating practice at Delray requires at least two dc units in operation at all times, and this practice limits somewhat the possibilities for carrying rated load on the rebuilt unit. However, the machine is always given preferential loading and is thus a "base load" unit to the extent permitted by operating requirements.

A reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

"Our gauge glasses are perfectly illuminated"

"This is a modern power plant," explained the Chief, "carefully planned to the last detail. There's a light over every gauge glass, so they're very easy to read. A red lined glass would undoubtedly help in some plants, but it's unnecessary here."

The fact is, however, that PYREX Broad Red Line Gauge Glasses are easier to read *anywhere*, in a well-lighted or a poorly lighted situation. Hang a small calendar and a big one on the wall. The big one is easier to read from across the room, *in any kind of light.* So is a PYREX Broad Red Line Gauge Glass—incomparably easier to read from a distance. That's a safety feature, as you well know. And it's a feature that saves steps and saves time.

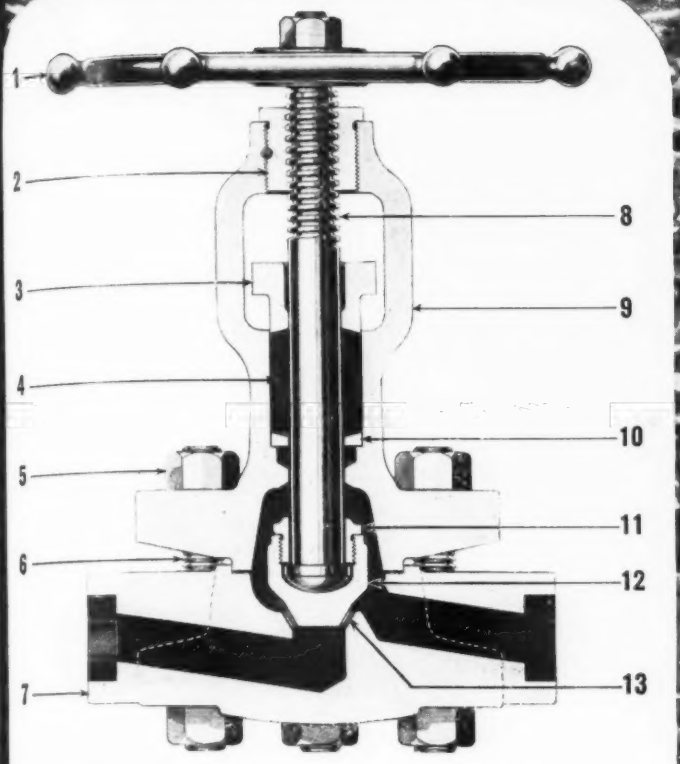
They also last longer, and that's your first demand. They're made of PYREX brand borosilicate glass—the same type of glass in which your wife likes to bake, and store things in the refrigerator—the same type of glass the chemical industry uses for piping because of its extraordinary resistance to corrosive action.

Next time, tell your jobber it's PYREX Broad Red Line!

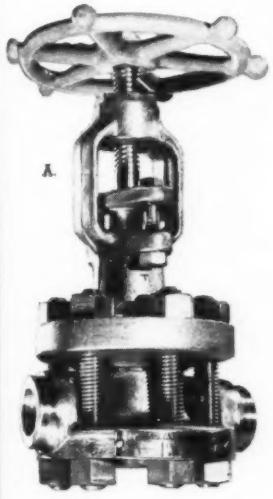
"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses



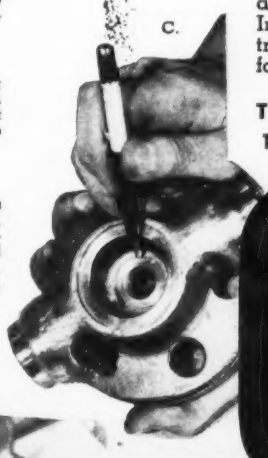
13 UNIQUE DESIGN FEATURES *Cut Operating Interruptions* LENGTHEN USEFUL VALVE LIFE



1. Handwheel—malleable iron, oversize and knobbed for easy operation.
2. Yoke bushing—cast bronze, replaceable. Extra length threading minimizes wear, prevents galling.
3. Gland—drop forged steel, through bolted, accurately guided.
4. Packing—braided asbestos, wire inserted jacket with plastic core.
5. Bonnet nuts—easily accessible ASA heavy nuts.
6. Bonnet studs—fully threaded, air cooled, equal length for evenly-stressed tight bonnet joint.
7. Body—forged carbon-molybdenum steel (cast for 2 in. Fig. 5264). Metal distribution equalized to make distortion in heating and cooling negligible.
8. Stem—heat treated and ground EValloy (stainless steel).
9. Bonnet—carbon-molybdenum steel. Deep stuffing box and cooling chamber prolong packing life.
10. Junk ring—hardened, accurately gaged and fitted.
11. Disk nut—finely finished heat treated stainless steel. Pressure tight joint permits leakproof backseating.
12. Disk—alloy steel with heavy layer of ground and lapped Stellite on wide contact face. Balanced symmetry and correct clearances prevent wear in service.
13. Seat—continuous ring of Stellite, integral with body. Perfect alignment with working parts.

A. Ready for hard work. Edward Intex globe stop valve Fig. 2264, socket ends, for 1500 lb, 950 F service. Note simple, sturdy construction.

B. No special tools needed for disassembly. Screw driver in slotted stem square makes it easy to assemble or remove stem and disk assembly.



C. Wear-resisting Stellite seat is part of body in Intex valves. This means greater protection against corrosion and erosion, fewer interruptions, less maintenance, longer life.

EXTRA PROTECTION against costly operating interruptions, easier maintenance, extra life, and greater fitness for tough service are built into Edward Intex* valves in 13 different ways.

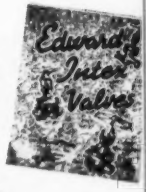
From the integral Stellite seat, which forever eliminates the possibility of leakage between the seat and body under high operating temperatures, to the easy-to-operate handwheel, every one of the 13 principal parts of Edward Intex valves have been designed for maximum operating efficiency under severe service conditions.

Like the integral seat, the contact face of the perfectly proportioned disk is generously faced with erosion-resisting Stellite. Valve ports are designed to give the least possible resistance to flow consistent with quick, positive cut-off.

Maintenance, though seldom necessary, is unusually simple. No special tools are needed for disassembly, and working parts are easily accessible.

Available in socket welding, screwed or flanged ends from ½ to 2 in., Intex valves are rated at 1500 lb sp at 950 F, but are equally trouble-free and economical in intermediate service.

*Reg. U.S. Patent Office.



Bulletin No. 12-G5 describes in detail the advantages of the smaller size Edward Intex valves. Full dimensional data, illustrations and material specifications. Write for your copy today!

THE EDWARD VALVE & MFG. CO., INC.
1220 West 144th Street East Chicago, Ind.

EDWARD *Steel* CAST AND FORGED VALVES

MURRAY

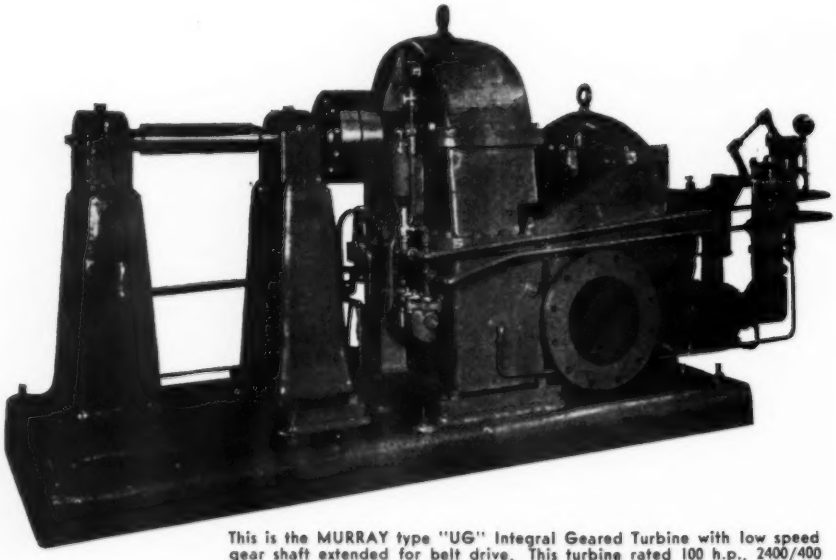
BOILERS . . . . . TURBO GENERATORS
MECHANICAL DRIVE TURBINES
ENGINES . . . UNIT HEATERS . . . GEARS

POWER facilities that help producers for Victory keep pace with demands

★ There is much required of producers for Victory these days as more and more war equipment is needed. Back of the machines and men that produce must be ample power facilities for power has always been the basis of production.

MURRAY EQUIPMENT is meeting all tests today as wheels spin and twenty-four-hour work days prevail. Design backed by 70 years of experience has made this possible.

If you are not a high priority holder we suggest that you learn the details of MURRAY EQUIPMENT—it is well now to plan for the future. Bulletins are available.



This is the MURRAY type "UG" Integral Geared Turbine with low speed gear shaft extended for belt drive. This turbine rated 100 h.p., 2400/400 r.p.m., operates at 160 lbs. initial pressure, D. & S. and 40 lbs. back pressure. This particular unit is in use driving a paper machine in a paper plant in Michigan.

BOILERS TURBINES ENGINES

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

Boiler Maintenance

(*Continued from page 73*)

tubes which resist corrosion-penetration longer. Removing deposits as they form prolongs tube life and often can be done by providing doors for effective hand lancing with air. Soot-blowers do not always reach all surfaces and under large deposits that form in corners, rapid corrosion results. Also, steam from soot-blowers can be harmful by increasing moisture in the flue gas.

The same general conditions can exist in air heaters, but the metal temperature on the cold end where corrosion first takes place is controlled by both entering-air temperature and leaving-gas temperature. Therefore it is important to obtain uniform distribution of gas and air over metal surfaces; otherwise, sections of the metal fall below the gas dewpoint and deposits and corrosion can start to accumulate.

Watch Cold Spots

Much can be done by watching for cold spots on the air-heater metal and by reducing these cold spots with gas and air baffling to distribute gas and air more uniformly. When high sulphur-and-moisture fuels are burned it may be advisable to bypass a certain amount of cold air around the heater or to circulate hot air through it during low-load periods. This keeps the metal temperature of the heater, which is lowest at low loads, above the point where deposits and corrosion take place.

Internal deposits and corrosion of economizer tubes are not so troublesome as in the past because most plants control feedwater better. Pitting of internal surfaces from oxygen corrosion has disappeared with the use of deaerators and the resulting oxygen-free water. Build-up of deposits in economizer tubes is uncommon with present-day feedwater practice. When deposits do form and cannot be washed out with air and water, it is becoming common practice to acid-clean economizers. Most modern economizers are so built that tubes cannot be turbined.

Leakage of air in boiler settings? This can account for loss of more heat than almost any other single defect. Of all maintenance jobs, stopping air leakage is undoubtedly the most uninteresting because it is difficult to tell when the job is done and almost impossible to see immediate results. But air leaks lie at the bottom of many ills such as slagging trouble, high stoker maintenance,

Official U. S. Army Photo

Here's What It Takes To Build Your Glory Road

When a Colonel of engineers said the new Alcan Highway—the "Glory Road of America"—was built by "guts and tractors" he stressed the former.

ALTER EGO: And how right he was! When tough "competition" from the west threatened to annihilate us, it jolted us into super-action. Alcan's 1800-mile route through uncharted wilderness — said to be *impassable* — was a confusion of mud, mountains and mosquitos. Under the spur of Jap "competition", we finished this "glory road" in one season.

Maybe that's a lesson for us to be on the alert for the tough competition that'll invade all business after the war. Let's jolt ourselves into super-action now.

ALTER EGO: Right! We've got to hack through plenty of uncharted wilderness that seems impassable . . . with little time on our hands . . . and come out with *better products* and *lower costs* than the other fellow. *Will-power* and *ingenuity* will build *this* "glory road".

We have the will-power. Let's acquire the ingenuity by improving our welding knowledge *with Lincoln's aid.*

Ask your inner self if welding knowledge isn't the shortcut to postwar success.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND, OHIO

INSPECT REGULARLY!

Don't neglect your **WRIGHT HOISTS.** Make them last longer by regular and proper maintenance. Here are a few suggestions:

Put the grease gun to work! A **WRIGHT HOIST** needs thorough lubrication once a month. Keep the load chain well lubricated, too.

Don't overload your hoist. While **WRIGHTS** are famous for their ability to stand abuse, this is no time to abuse machinery. Overloading results in a stretched chain which cannot seat itself properly in sheave pockets, thus accelerating wear.

Watch the load hook. WRIGHT hooks, drop-forged from special steel, give visible warning of overloading by slowly opening. Don't continue to use hooks that have stretched.

Inspect your hoists regularly. Remember: where properly maintained, **WRIGHT HOISTS** have given continuous, trouble-free service for 20 to 25 years.

In Business for Your Safety

ARMY NAVY E — Flying Over the WRIGHT HOIST PLANT

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, San Francisco, New York

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT, CONNECTICUT

burner difficulties, superheat troubles, and low efficiency. A check of excess air at the boiler or air-heater outlet will not reveal the amount of air leakage that exists. The best answer comes from a check of the excess air at the furnace outlet and at either the boiler or air-heater outlet. Excess air determination at furnace outlet where gas temperatures are high can easily be made by using a water-cooled sampling tube. Determining the extent of leakage establishes a goal for stopping it, while persistent checking and stoppage of small leaks gives surprising results.

AIEE Convention

(*Continued from page* 92)

short periods with high river flow and simultaneous high ambient temperatures and is not a normal condition.

27. In certain cases, improvements in baffling of generators has cut down recirculation of air and increased output.

28. Capacity of a bank of air-cooled transformers was increased by building a duct to conduct cooling air outdoors after it had passed through the transformers.

New Generator Housings

29. New housings on horizontal waterwheel generators have reduced recirculation of cooling air and winding temperatures about 12 C.

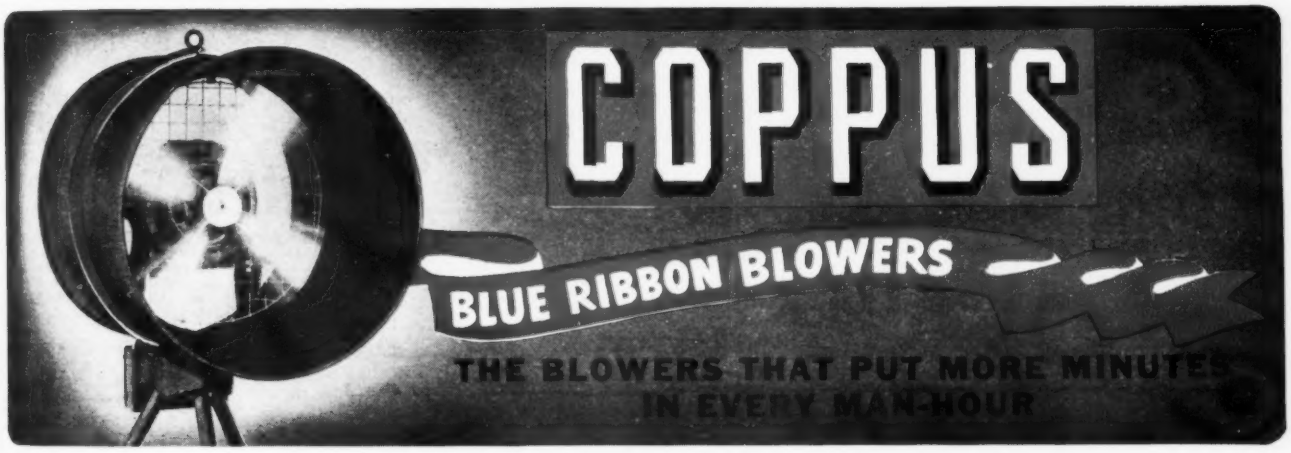
30. During low-river stages in summer recirculation of condenser water at a 75,000-kw plant raises river-water temperature to 96 C. This limited the output to 53,000 kw under extreme conditions by rise in temperature of cooling water to generator air coolers. Installation of 4000-gpm cooling tower for a closed cooling-water system allows plant to carry 85,000 kw under these extreme conditions, thus releasing 32,000 kw of capacity. Cooling tower will require a 200-hp motor.

31. Reinsulation of a 30,000-kva synchronous condenser is planned from composite insulation to straight class B insulation, because the class A part of the composite insulation has had about 20 years' service. Policy has been to specify class B insulation on all major rotating equipment purchased for the past few years.

32. On three 33,000-kva hydro-generators, corona was affecting the coils next to line terminals; only change in recent years has been to reverse line and neutral connections.

Fresh Air for More Work

YOU CAN MAKE IT EASIER FOR YOUR MEN TO PRODUCE MORE WORK BY PUTTING A COPPUS BLOWER OR HEAT KILLER ON THE JOB



WHERE it's hot or stuffy, working efficiency sags.

But with Coppus "Blue Ribbon" Blowers and Exhausters on the job ...you can keep men cool and comfortable working near furnaces ... in tanks ... in underground cable manholes ... around hot processes.

They're portable, adaptable for special purposes, each one built to Coppus "Blue Ribbon" standards—which means precision-workmanship, rugged construction.

Get more work from men whose work helps win the war. Coppus Blowers and Exhausters will save those lost minutes that add up to so many wasted hours each day.

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS ... DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 303 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

NAME.....

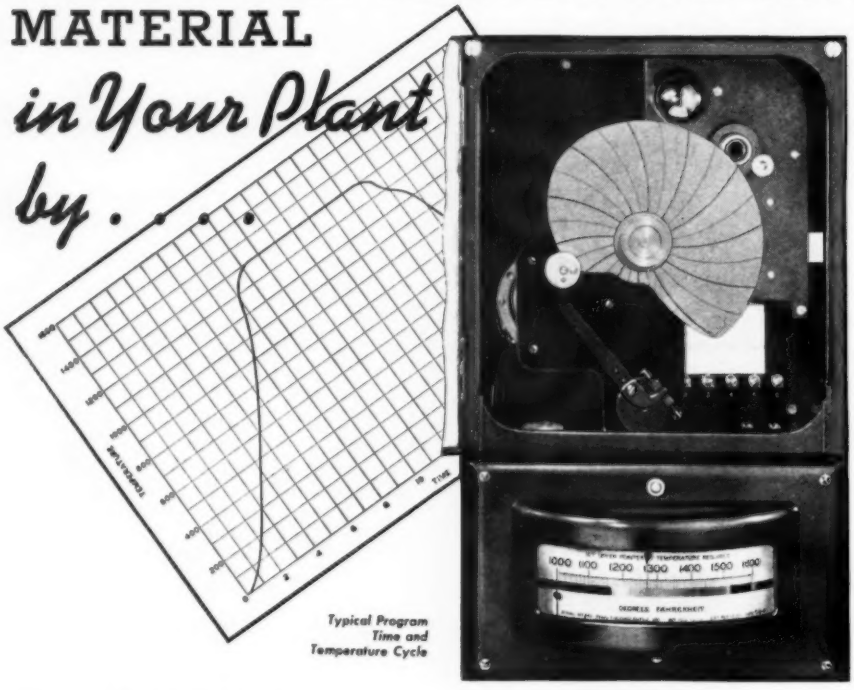
COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have.)

Save VITAL MAN HOURS and MATERIAL *in Your Plant by . . .*



Typical Program Time and Temperature Cycle

Program Capacitrol

AUTOMATIC ENFORCEMENT of . . . . your HEATING or COOLING CYCLES

Wheelco UNIVERSAL Controllers, with Program Control integrally incorporated, will permit you to produce MORE, BETTER—WITHOUT WASTE.

These Controllers provide dependable enforcement of any heating or cooling cycle, with completely automatic temperature regulation, plus the Proved-in-Service Superiority of "Electronic Principle" Control, which eliminates the faults inherent in all mechanical controllers.

Program Control is effected by means of a synchronous motor driven disc, which is so contoured as to move an arm, mechanically Coupled to the temperature setting lever of a Wheelco "Electronic Principle" Controller, to produce the desired program. Discs can be contoured in your own shop.

UNIVERSAL Program Controllers are available as Capacitrols, Potentio-trols or Resistance Therm-otrols, and adaptable to all types of processes for measuring, indicating and controlling temperatures from 0 to +3600°F., or equivalent °C.

Write for your FREE copy of Bulletin No. Z6100.

Wheelco Instruments Co.

863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

Originator of "Electronic Principle" Temperature Controls

33. When motors fail in locations subject to high ambient temperatures, they are rewound with glass insulation. This is expected to prolong life of motors materially, as well as give overload capacity when needed.

34. Field of a hydro-generator was reinsulated several years ago with class B insulation instead of class A to permit increased condenser operation with lower insulation deterioration.

35. In reinsulating generators, mica tape with a finishing layer of glass tape is substituted for varnished cambric on coil ends. Expected to prove much more durable and less liable to damage in replacing a coil.

36. In the past, armatures of three 33,330-kva turbine-generators have been rewound with transposed strands and modern insulation. Rating of each was increased to 36.667 kva.

Motors Reinsulated

37. One plant reinsulated some large auxiliary motors. By changing from class A insulation to class B, they increased rating from a deficient 900 hp to 1000 hp.

38. Three 3000-kw hydro-generators are installed in one plant; stator winding of one failed several times. In order to increase capacity, this stator was completely rewound, class B insulation replacing class A. Now all spare coils are provided with class B insulaton for use on either the generator having class B insulation or on the two having class A.

39. Silverplating of switch contacts, blades and busbar joints has been standard practice for several years; results have been excellent.

40. One plant silverplated all bus joints and connections, all disconnect blades and clips. This cut maintenance cost and resulted in safer operation because the bus system was considerably overloaded. Results satisfactory and well worth while.

41. Silverplating of disconnect switch contacts has increased rating of such equipment 20%. Silverplating of breaker contacts has increased rating 20 to 50%.

42. Silverplating of contacts has been a standard for years on all new equipment. On a large amount of old equipment, such as breakers, contactors and drum switches, contacts have been silverplated prior to the present emergency when equipment approached a load that warranted a change. Results have been uniformly good.

43. Eight other plants indicated that silverplating increases current—carrying capacity of contact parts.

How Lubrication Engineering Saves...

gallons of oil...hours of down-time...scarce repair parts...and reduces hazards

HERE'S an example of the materials and money you may save if you let a Standard Lubrication Engineer analyze troublesome lubricating problems.

This was the job. A central state war plant operated a steel scrap baler. A hydraulic pump and cylinders compressed the steel. Air cylinders pulled back the hydraulic ram for quick-return.

Some of the problems. Leakage and sludging were troublesome on the hydraulic system. The floor around the pump and valves was continually soaked with oil—a definite labor and fire hazard. It took 100 to 150 gallons of oil per month to operate the unit. Wear on pump and cylinder packings was excessive.

On the air cylinders, synthetic rubber piston rings were being replaced every few days, at a cost of $16.00 each, plus labor and lost machine time.

...reduces hazards

...saves costly rings

What the Lubrication Engineer did. He found that paraffine oil was being used in the hydraulic system. The high operating temperatures lowered the viscosity of this oil, resulting in poor lubrication, wear, and leakage. He recommended Stanoil—an oil particularly suited for hydraulic systems because it changes less in viscosity over a wide range of temperatures. This means that, at low temperatures, it flows readily to the pump when starting, and still maintains its lubricating quality at higher temperatures. It also resists deposit formation, frequently troublesome in these systems. Evidence that Stanoil cured the leakage trouble was shown, not only by the clean, safe, oil-free condition of the floor around the unit, but also by a drop in oil consumption from over 100 gallons per month to 25 gallons per month in the two months since Stanoil has been used.

When the air cylinders were examined, they were found to be pitted and rusted. A special oil, developed for lubricating air drills, was recommended. In spite of the pitted cylinder walls, which have not been reconditioned, this oil is giving such excellent lubrication that no synthetic rings have been replaced in two months. Cylinders are entirely rust-free.

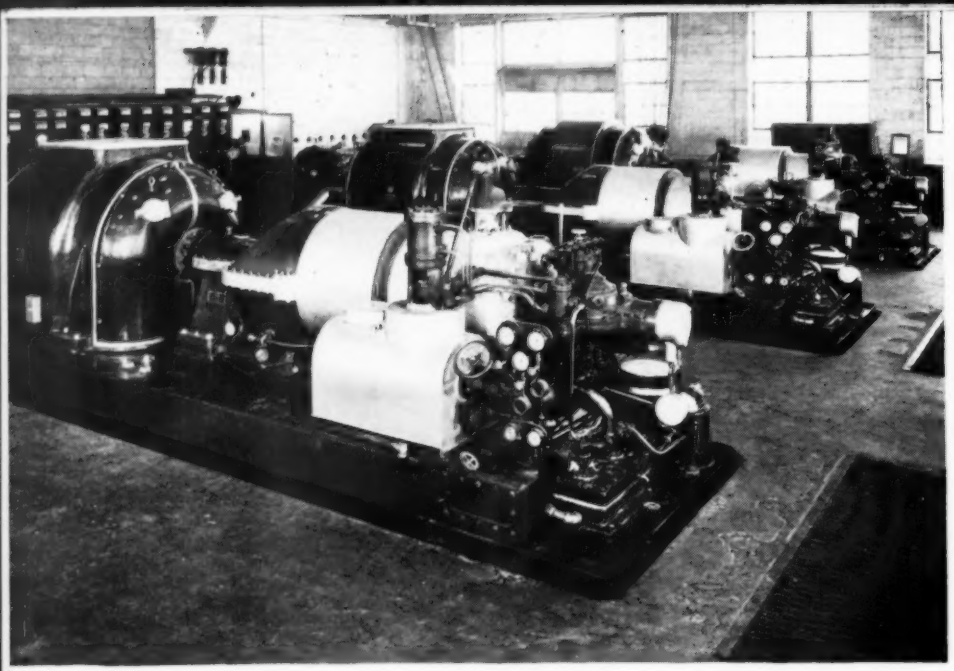
...reduces oil consumption

As a wartime measure Standard Lubrication Engineers are available, at a moment's notice, to all plants producing war materials in the Middle West. Just call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you when any problem involving lubrication develops.

STANDARD OIL COMPANY (INDIANA)

Oil is Ammunition...Use it wisely

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...



Records made on the three turbines above show how clean turbine oil systems stay with Nonpareil Turbine Oil.

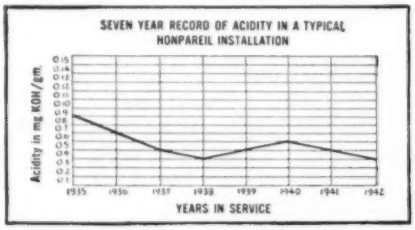
Service record shows how to get cleaner turbine operation

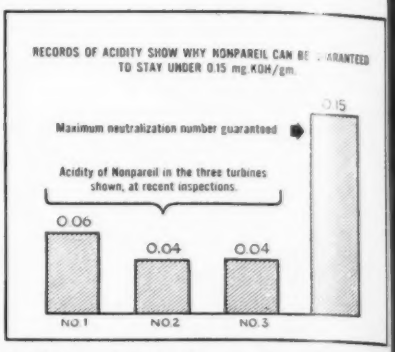
A comparison of turbine oil operation is difficult to make. Conditions vary from plant to plant. The type of turbine, and operating practices and needs affect oil performance. But here is a case where conditions were, as nearly as possible, identical—where the performance of an oil that is fully protected against acidity and sludge formation could be fairly rated in direct comparison with a conventional oil.

Here are the conditions. The three 1500 KW turbines in a middle western power plant, shown above, are the same make. All operated eight years on Nonpareil Turbine Oil. All maintained an excellent record for low acidity and cleanliness. Then, for reasons not connected with the oil, the No. 3 turbine (extreme right in the picture) was filled with a conventional oil. And troubles started popping. Bearing temperatures rose. Sludge clogged oil screens. Oil had to be centrifuged continuously.

Another turbine was tried. When the troubles continued, it was thought that some mechanical difficulty in the turbine might be the cause. At the yearly overhaul period, No. 3 turbine was put back on Nonpareil, and turbine No. 1 was filled with a new batch of the conventional oil. The troubles switched over to No. 1. Bearings overheated; screens clogged and had to be cleaned every 60 days.

Back to normal. In the meantime, turbine No. 2 which had operated continuously, and No. 3 which had been refilled with Nonpareil, were giving no trouble. Acidity was low, and screens and coolers were cleaned only at the yearly inspection period. That was enough evidence for this operator. Nonpareil Turbine Oil is again in all three units.





Acidity control in Nonpareil. The low acidity of Nonpareil in the three turbines, as shown by the figures above, is obtained by the use of a *patented* inhibitor which is added to a highly refined oil from which the asphaltene-forming hydrocarbons have been removed. This also accounts for the unusually clean operation secured with Nonpareil. Its neutralization number is *guaranteed*, in writing, not to exceed the low limit of 0.15 mg.KOH/gm. for the life of your turbine.

COMPARISON OF SERVICE REQUIREMENTS BETWEEN NONPAREIL AND COMPETITIVE OIL

Noted during the period when turbine No. 1 was operating on a competitive oil and turbine No. 2 was operating on Nonpareil.

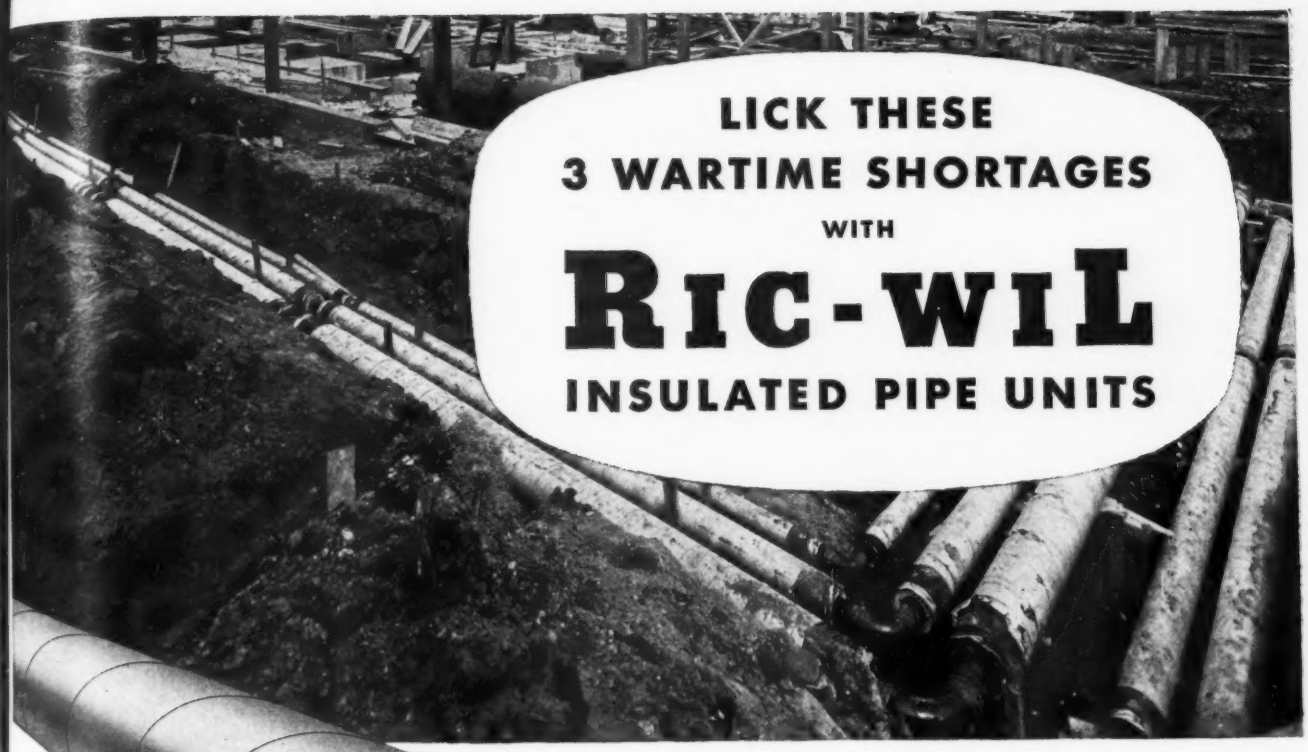
	Nonpareil	Other Oil
Oil Centrifuged . .	Every 30 days	Continuously
Screens cleaned . .	Yearly	Every 60 days
Oil replacements .	None	Yearly
Bearing temp. . .	140°—145°	160°—165°

Get all the facts. A Standard Lubrication Engineer can tell you many other operating advantages of this patented type of turbine oil. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska, at Omaha.

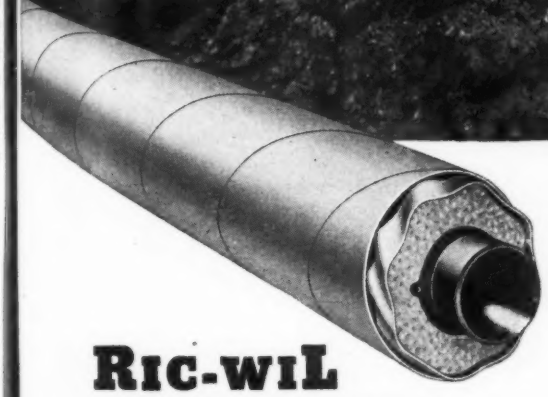
★ NONPAREIL TURBINE OIL ★

OIL IS AMMUNITION . . . USE IT WISELY.

STANDARD OIL COMPANY (INDIANA)



LICK THESE 3 WARTIME SHORTAGES WITH RIC-WIL INSULATED PIPE UNITS



RIC-WIL
INSULATED PIPE UNIT

Ric-wiL Insulated Pipe Units are an essential product and are definitely aiding America's war effort. They are relieving Three wartime shortages — manpower — transportation — critical materials and currently speeding to completion many urgently needed products.

When planning distribution systems for steam, hot water, oil, hot or refrigerated process liquids, consider, in addition to the features of fast installation, economical operation and low maintenance, these timely advantages —

MANPOWER

TRANSPORTATION FACILITIES

CRITICAL MATERIALS

1 **Ric-wiL Insulated Pipe Units are factory prefabricated (except at the joints). The installation is speedily accomplished, skilled mechanics and man hours required are reduced to an absolute minimum. Despite man-hours saved, the result is a permanent, low maintenance system — the best you can install.**

2 **Ric-wiL Insulated Pipe Units are designed to occupy absolute minimum space. They are shipped in gondola cars of which there is no shortage. Their uniform shape and lighter weight permit compact loading and require only smallest amount of critical transportation equipment.**

3 **Sound engineering holds critical materials in Ric-wiL Insulated Pipe Units to an absolute minimum — only 15% to 20% of total weight — used only where substitute materials cannot give the necessary mechanical strength required for a distribution system connecting your vital operating units.**

When Makeshifts Won't Do — **RIC-WIL**

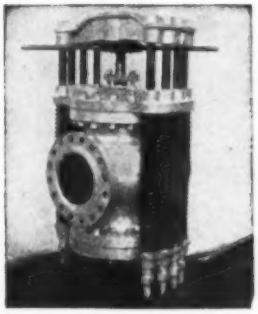
If you desire a copy of the Ric-wiL Engineering Data Book, simply write on your letterhead.

RIC-WIL CONDUIT SYSTEMS FOR UNDERGROUND STEAM
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

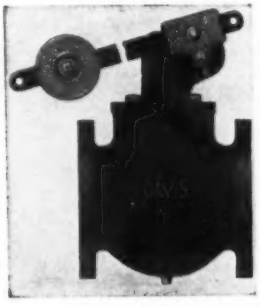
YOU CAN *DEPEND* ON DAVIS AUTOMATIC RELIEF VALVES

BECAUSE automatic relief valves are so vital to the protection of power plant equipment and to efficient plant operation, it pays well to buy the best and to inspect and maintain them regularly. Thorough dependability is the keynote of Davis relief valve design. Patented features plus careful construction and finest materials assure this. As an additional safety feature, most models can be equipped for manual control and hand testing, and Davis engineers will recommend the *right* valve for any job. For pressure relief to atmosphere or to low pressure lines, vacuum relief, pump by-pass and protection of equipment, specify Davis. Write for literature.

DAVIS REGULATOR COMPANY
2540 S. Washtenaw Ave., Chicago



Left — No. 265 Turbine Bleeder and High Pressure Relief Valve.



Left — No. 80 "No'seless" semi-balanced Back Pressure Valve for exhaust lines.

FOR EVERY JOB
Steam—Air—Gas—Water
—Oil
PRESSURE RELIEF
VACUUM RELIEF
ATMOSPHERIC RELIEF
PUMP BY-PASS

Right — No. 110 Exhaust Relief Valve for condenser protection service.

DAVIS REGULATOR COMPANY

Electronic Control

(*Continued from page* 92)

more of the tubes should fail. In this system, the circuits have been so designed that the equipment is safe regardless of which tube or combination of tubes fails. The equipment will either shut down instantly or will continue to operate, deprived of the function of the tube which fails.

Many interesting applications of the Thymotrol drive have been made, most of them to machine tools because of the present limitations in size. Among those to which drives have been successfully applied are grinders, milling machines, tool-room lathes, turret lathes, and thread millers. In addition, they have been supplied for automatic welding machines and for various special equipment for testing magnetos, airplane-propeller governors and instrument tachometers. Fig. 4 shows a standard Thymotrol panel applied to a milling machine.

A particularly interesting application has been made for driving the headstock on grinders. The wide speed range obtainable and constant-torque characteristics provided at low speed make it possible to provide the right speed for every type of grind. In several instances, the new control has made possible a simplification in the headstock itself through the elimination of gears and pulleys formerly required.

Another important factor in this application is that the equipment can be mounted on the grinder without fear of introducing any undesirable vibration such as might be produced with high-speed rotating apparatus. The machine can be made self-contained, and it can be moved at will without worry about availability of dc power.

For reversing-table drives, two independent speed-adjusting potentiometers make it possible to provide full-range, independently adjustable speed for both directions of travel. A simple relay for selection between the potentiometer and a standard double-throw limit switch are all the additional material needed.

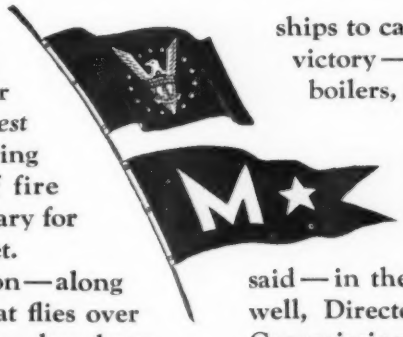
Readers' Problems

(*Continued from page* 113)

and preventing recontamination requires that three conditions be maintained: (1) The water must be at boiling temperature for the corresponding

TAKING THEIR PLACE

beside those who "Praise the Lord— and Pass the Ammunition"



UPON the work clothes of every A. P. Green employee is worn the U. S. Maritime Commission's Labor Merit Badge—*the Commission's highest award*—in recognition of outstanding achievement in the production of fire brick and refractory materials necessary for lining the boilers of the Victory Fleet.

This Award of Merit in production—along with the Maritime "M" pennant that flies over the A. P. Green Fire Brick plant—has been accepted with pride and is worn with the realization that it carries a great obligation. Without ships to carry needed supplies there can be no victory—and without fire brick to line the boilers, these ships can not sail the seas.

Every day—twenty-four hours a day, A. P. Green workers are turning out fire brick and refractories to help give America the materials needed for victory. Truly it can be said—in the words of Colonel Willard F. Rockwell, Director of Production for the Maritime Commission, "These A. P. Green men—and women, too—are taking their place beside those who praise the Lord and pass the ammunition."

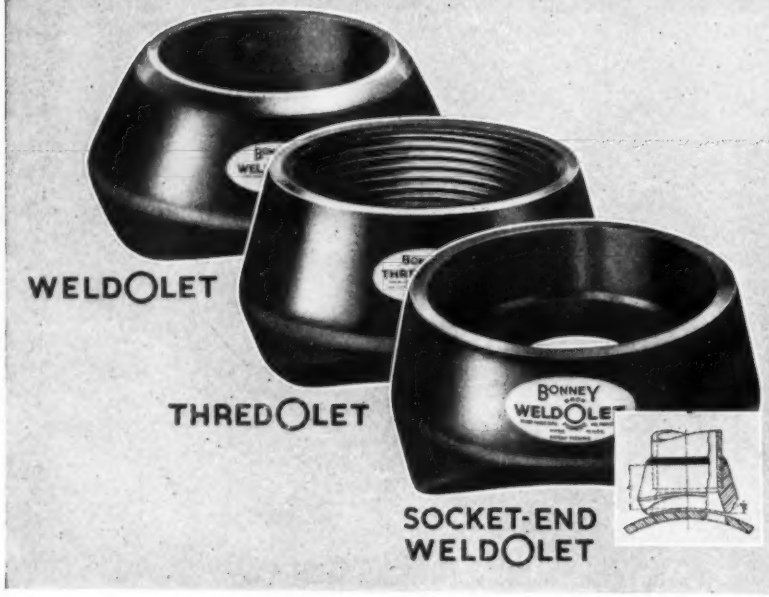
the First Name in Refractories

A. P. GREEN
FIRE BRICK COMPANY
MEXICO, MISSOURI

Fireclay Brick . . . Super Duty Brick . . . High Alumina Brick . . . Special Refractory Tile
Insulating Fire Brick . . . Plastic Fire Brick . . . Mortars . . . Maintenance Coating Materials
Refractory Castables . . . Oil Burner Combustion Chambers . . . Industrial Insulations

A. P. GREEN FIRE BRICK CO.
MEXICO, MISSOURI
Offices: NEW YORK • CHICAGO • DETROIT • ST. LOUIS • TORONTO

DEPENDABLE



YES sir! Bonney WeldOlets and ThredOlets *are* dependable. So dependable they provide leakproof, right-angle, welded branch pipe outlets of full pipe strength without the use of templets, cutting, threading or alignment of the main pipe. Installed by electric-arc or oxy-acetylene method and any welder of average ability, they provide junctions that improve flow conditions . . . reduce turbulence and friction to a minimum.

Light in weight, they save metal, eliminate the need of extra braces at the junction . . . save money on original cost when compared to tees . . . plus time and money in actual installation.

Suitable for all commonly used pressures and temperatures and available from stock for all pipe sizes up to 12"...on special order up to 24". Stock fittings are drop forged steel . . . but to meet unusual conditions they can be furnished in Monel, Everdur, Toncan Iron, Wrought Iron, etc.

Get this 16 page bulletin that tells in detail all the advantages of these fittings. Write for Bulletin WT31.

Once used, you'll never use any other welding fittings for making right-angle, welded branch pipe outlets.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

WELDOLETS • THREDOLETS

TRADE MARKS - REG. U.S. PAT. OFF.

. . . *Welded Outlets for Piping* . . .

pressure over the water. (2) Sufficient heat must be supplied to insure thorough agitation of the entire water body. (3) Evaporation of enough water to provide a current of vapor flow above the liquid which will positively remove the liberated gas from the vessel. If above atmospheric pressure, such vapor and gases may be vented, otherwise an ejector or vacuum pump is required.

If boiler pressure falls to zero each night the boiler water itself may be absorbing oxygen because a vacuum forms as steam condenses, causing leaks at gage glass and other fittings. This could be corrected by feeding sodium sulphite to maintain an excess of 30 ppm. It is normally necessary to feed sulphite for this purpose in a plant fitted with a deaerator. If this condition occurs nightly the quantity of sulphite required may make increased blowdown necessary. The quantity of sodium sulphite required is usually 1 lb per 10,000 lb of boiler water for each outage with complete loss of pressure.

Since operation is satisfactory except during the starting-up period it is suggested that the following procedure be adopted to remove the oxygen absorbed in the feed water tank:

1. Install an open heater in the tank.
2. When shutting down the boiler raise the water level above normal.
3. On starting up, as soon as steam (any pressure) is available, and before pumping to boiler, open heater valve and raise water temperature to 212-215 F.
4. Shut off open heater and start normal operation on the basis described for reducing the oxygen content to the recommended minimum.

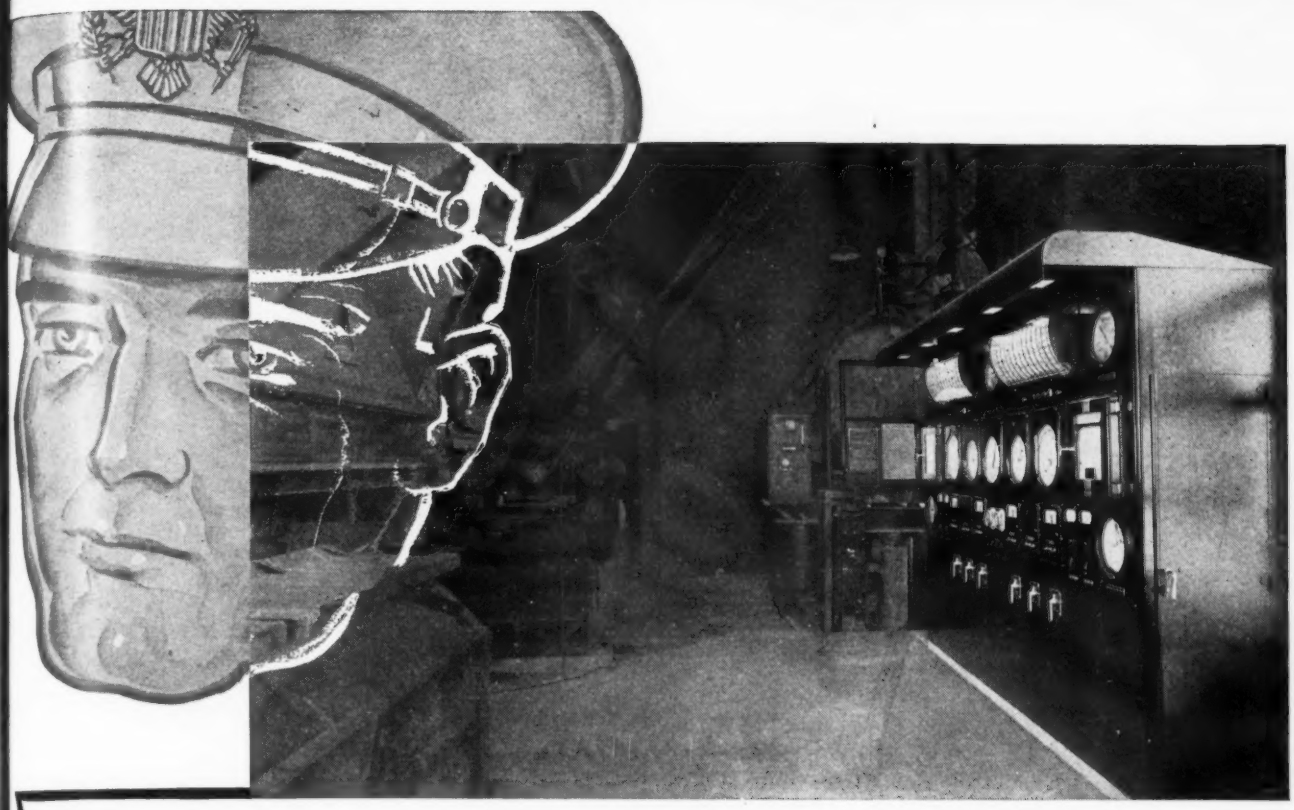
This method will involve a lower power cost and less control equipment than applying a vacuum connection to the tank. The feed pump will have to be located from eight to ten feet below normal tank water level.

If returns and raw water are introduced in spray form the use of a small open heater may be more effective in removing oxygen than the circulation method described for regular operation.

St John, N. B. C G CLARK

Use Separately Fired Heater

ONE OF THE THINGS WFF can do to eliminate the oxygen from the boiler feedwater is to connect up the feed tank with a heater which will maintain the water temperature at or near the



LIKE A GOOD OFFICER, HAYS COMBUSTION CONTROL *Uses its head*

HERE'S a combustion control system that has no truck with guess work. It sticks to facts. It measures all variable elements, and regulates them. It corrects automatically, on the instant that need for correction is indicated. It even measures the corrections — sees that the right balance is maintained. In short, like any experienced, capable officer, it "uses its head," to get the most efficient performance possible from the equipment under its control.

Throughout the country, in many industrial power plants, Hays Combustion Control is on the job, using its head to the benefit of war production. It is making present equipment deliver more steam capacity, more efficiently. It is saving countless man-hours and dollars.

It's easy to learn how this versatile system can give you the kind of economical, capable, heads-up job you want done: simply write for the Hays Combustion Control Catalog. It's full of concise, useful data on maintaining efficiency in a steam power plant.

HAYS

THE MODERN SYSTEM *It's Electrical*

Automatic COMBUSTION CONTROL

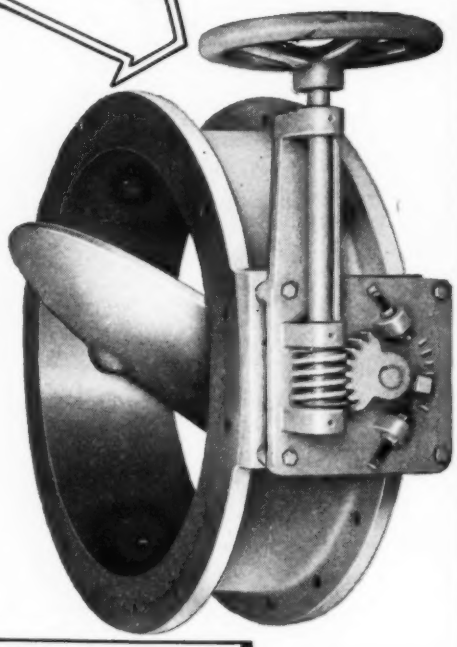
THE HAYS CORPORATION • MICHIGAN CITY, IND.

6 Hand Wheel Revolutions

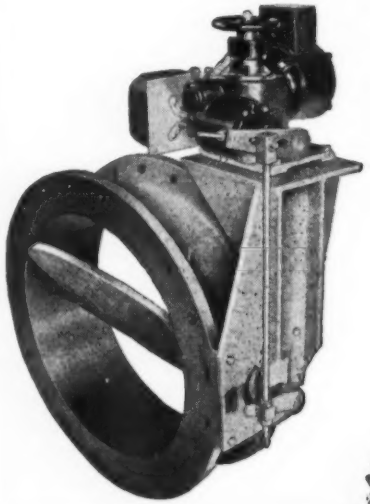
Complete Full Vane Movement

Designed for the control and wedge-tight shut-off of any material that flows or is forced through a pipe

Six revolutions of the hand wheel fully open or close this R-S Butterfly Valve. Compare this quick action with that of ordinary valves. Consider, too, that R-S Valves are comparatively light in weight. They effect a considerable saving in installation costs since less space and supporting structure are required.



15 to 900 p. s. i.



Electric Motor Operated

Here is a simplified, precise and entirely Automatic Butterfly Valve for the shut-off and control of liquids and gases in power plants, water works, chemical industries and refineries. Hand wheel for manual operation in case of current failure. Available in iron or steel; sizes to 84 inches.

•

Detailed information and catalog furnished upon request.

BUTTERFLY VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

boiling point during the time the boiler is shut down.

The heater may be an ordinary cast-iron oil-fired heater such as is used for domestic water heating, or an electric immersion heating element such as is used in commercial water heaters. Either should be automatically controlled.

If the boilers are so well insulated that they hold steam overnight then it might be possible to install a steam-heating coil in the feedwater tank and keep the tank hot by a thermostatically controlled valve. This would probably require a condensate pump to remove the condensate from the coil and put it back in the boiler.

A variation of the method of using the boilers as the heat source would be to connect the tank coil with the boilers below the water line so the boiler water would circulate through the tank coil. This might be done as a gravity job if the tank is located higher than the boiler, otherwise, it would require a circulating pump.

The vacuum pump could be reconnected to maintain a vacuum on the tank but it would take heat out of the water in the tank, thereby cooling it down and would cost more to operate than an immersion electric heater.

Columbus, Ind. I A BUTCHER

Raise Water Temperature To Drive Off Oxygen

THE CONDENSATE in WFF's plant can be returned if the receiver is large enough to hold it without overflowing to the sewer.

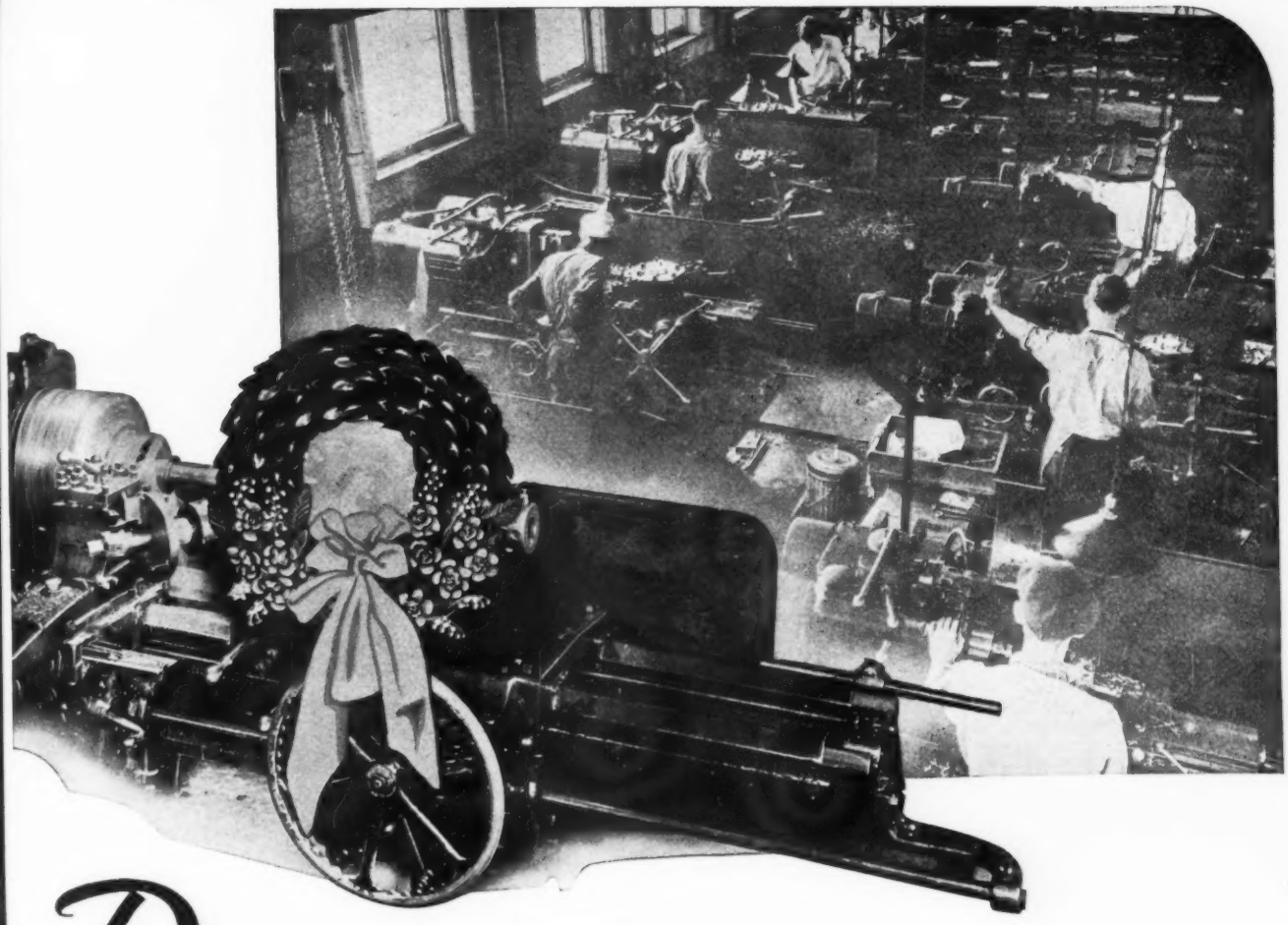
With 10 psi pressure the temperature of this steam at absolute pressure is 240 F and when it returns to the feed tank it would then drop to approximately 210 F.

What little oxygen remains in the feedwater at this point in the system can be taken care of in the boiler by adding feedwater compound and blowdown of the boiler.

As for the vacuum pump I don't believe it will be needed if the boiler-feed pump is located at least 6 ft below the feed tank.

If the temperature drops to 180 F or less in the feed tank the water can be circulated through the heater and returned to tank. After the water temperature has reached the desired point, then the bypass can be shut so the feedwater can feed into the boiler. This circulating and raising the temperature rids the water of its oxygen content.

Philadelphia, Pa. T F CUNNINGHAM



Decoration... for INDIFFERENCE

No medals . . . no wound stripes . . . no citations for the men on the industrial casualty lists!

They are maimed or killed . . . just as surely as if by snipers' bullets or enemy bombs . . . by carelessness, or ignorance, or indifference. And the appalling fact is that day after day these home front casualties keep mounting . . . more, many times more than are reported from the fighting fronts.

For forty years, Youngstown has had an active Safety Program in all its plants. Today, facing increased hazards of war production on the one hand and the need for maximum effective manpower on the other, we have redoubled our efforts to educate and protect our workers. We subscribe to and give our fullest support to the work of the National Safety Council.

As customer, prospect or friend, we urge that you, too, get behind this work. Enroll in the cause of the National Safety Council. Send a subscription to National Chairman Wm. A. Irwin, 71 Broadway, New York City, for the War Production Fund to Conserve Manpower. Do all you can to help America win this war on the home front.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

Supervised Boiler and Condenser Cooling

System Protection at Moderate Cost!

We believe the true answer to your boiler water and condenser cooling system problem lies in competent supervision of water conditions by experts plus a simplified natural method of water correction. Our new Technical System does just that! Scheduled supervision and treatment based on frequent water analysis finds and remedies your trouble . . . specific organic formulas developed individually to fit your needs provide a simplified, natural correction. Send the coupon below for the new Technical System bulletin or have a Water Treatment Company engineer inspect your plant without obligation.

WHY NOT SEND THIS COUPON *NOW*? . . . to

American Radiator & Standard Sanitary
New York CORPORATION Pittsburgh

Cleveland, Ohio Columbus, Ohio Erie, Pa.
Fort Wayne, Ind. Toledo, Ohio

BAILEY-FARRELL COMPANY
Charleston, W. Va. · Huntington, W. Va.

MUTUAL SUPPLY CO., Cincinnati, Ohio

or send to

☐ Please send the new Technical System bulletin.
☐ Have a Water Treatment Company engineer call.

Name ..... Title .....

Company .....

Address .....

WATER TREATMENT COMPANY *of America*
3459 HOOKSIS STREET · PITTSBURGH, PA.

Power Clinic

(*Continued from page 98*)

or 3-cornered coarse file. How many teeth to cut is a matter of judgment, but 18 is about right for a 2-in. pipe. See sketch.

Now, place the toothed end of the pipe over the horn of an anvil, raise the back end somewhat and flare the teeth out from $\frac{1}{16}$ to $\frac{1}{8}$ in. with a ball-peen hammer. This is most important to give the drill clearance.

Next step is hardening. Using an acetylene torch with an excess-acetylene flame, heat the teeth almost white hot. Then flow cast-iron welding rod all over the teeth. The purpose of the excess acetylene and the cast-iron rod is to add the carbon that is lacking in the soft steel of the pipe.

If the cast iron accumulates in drops, remove them by striking the pipe a sharp blow with a hammer. While the pipe is still white hot, plunge it quickly into cold water to harden the teeth.

It is advisable to insert a shouldered plug in the striking end to prevent the hammer from mushrooming the pipe. I recently used one of these drills to remove a $1\frac{1}{2}$-in. water line running through an 18-in. concrete wall. The drill made of 2-in. pipe, slipped neatly over the embedded pipe as shown.

Mexico, Mo. D KINCAID

Engineers' Books

(*Continued from page 122*)

Other chapter headings include: Raw Energy; Steam-Power Plant—Combustion Theory and Equipment; Steam-Power Plant—Steam-Generating Units; Steam-Power Plant — Prime Movers; Steam-Power Plant—Condensate and Feedwater Systems; Steam-Power Plant —Applications; Diesel and Gas-Engine Plants; Hydraulic Power Plants; and Power-Plant Development.

Diesels

AMERICAN DIESEL ENGINES (1943) *By E F Goad, Licensed Chief Engineer. Published by Harper and Bros, 49 E 33rd St, New York, N. Y. 336 pages, 6x9 in., illustrated, cloth covers. Price $2.75.*

Written for vocational and training-school use, this new book should prove of benefit to the engineer interested in

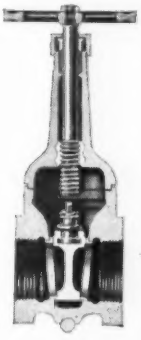
DON'T CUT OVERLENGTH THREADS ON PIPE!

Overlong threads on the pipe may strike the diaphragm of the valve and distort it, or may make it impossible to get a tight joint without the use of excessive amounts of joint compound —or other inadequate practice.

So, when cutting threads on the pipe, work to the gauge length established by standard. Do not exceed standard dimensions and standard tolerances.

Blow out the new line—and the valve—to make certain that no grit will be deposited on the valve seat. Then apply joint compound to the *pipe* threads—*not* to valve threads.

Take precautions such as these to guard your valves for the duration.



Don't reassemble a valve without exact knowledge of its construction. Avoid the possibility of ruining a valve—and having a costly shut-down—by consulting the valve manufacturer's catalog.

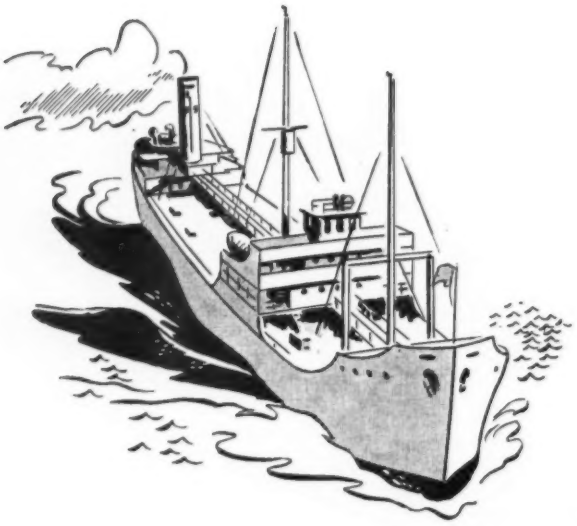
Write to Reading, Pa., general office, for copy of "VALVE DON'TS" —a poster for plant use that tells things NOT to do to valves.

READING-PRATT & CADY

MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT**

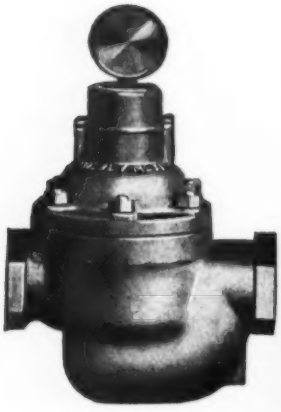


MEASURING THE "Life Blood" OF OUR MECHANIZED ARMY

Endlessly our tankers ply across the seven seas—braving storms and submarines to bring to our mechanized forces the oil and gasoline so vitally necessary for their continued operation.

Henszey Boiler Feed Water Meters are riding the waves on many of these tankers—to be there to accurately measure the precious liquid at the end of the long haul. They do this tough job exceedingly well. Yes, do it well, because they were designed with a minimum of working parts without close clearances. They are particularly fitted for this new job.

This tough assignment is only one of the many jobs performed by Henszey Meters in war industries. Applications include the measuring of boiler feed water, hot, dirty blowdown, condensate, free running chemicals and many other liquids that cannot be satisfactorily measured by ordinary meters. They are equally accurate at high or low flow—high or low pressures—on duplex, triplex or centrifugal pumps. Sizes range from 10 g.p.m. to 1200 g.p.m., cold water, steady flow rating. Pipe connections ¾" to 6", special sizes to order. Calibrations can be made to read in gallons, pounds, or cubic feet at any specified temperature. The meter is easily installed right in the line.



Send for full information

HENSZEY COMPANY

Dept. D3 • Watertown, Wis.

HENSZEY
BOILER FEED WATER
METERS

HENSZEY BLOWDOWN SYSTEMS

BOILER FEED REGULATORS • FLOW INDICATORS
PROPORTIONING VALVES • HEAT EXCHANGERS

learning the basic facts about diesel-engine operation and maintenance.

Written in non-technical language for the mechanic and inexperienced student, the book devotes three chapters to explaining the principles of the diesel engine and its fuel. Five chapters give a brief summary of the construction features of modern engines and accessories. The remainder of the book, eleven chapters, covers the application of diesel engines, methods of operation, and maintenance and repair procedures. One chapter is devoted to truck and tractor diesel maintenance.

The fact that the approach is non-technical and a wide array of subjects is covered in a relatively small book makes this volume particularly suited for the junior engineer or for the engineer not familiar with diesel practice.

Meteorology

A START IN METEOROLOGY. *By Armand N Spitz in charge of the Department of Meteorology, The Franklin Institute, Philadelphia, Pa., with the cooperation of Mrs Harry Thomas Jordan. Cloth bound, 95 pages, 5x8 in. Price $1.50.*

According to the preface, Mr Spitz set out to write a book on "Meteorology" for young people. He has done that, and more. Technical authors generally talk over the heads of their readers, but in producing this little masterpiece for the "boys and girls", Mr. Spitz has made a book perfectly adapted to the average adult who wants to know something about the weather without too much labor. The editors can certify that this little book contains a lot of valuable information on points not understood by the average graduate engineers, and that the story is told in a most helpful and graphical way.

The excuse for this review is that the weather is of professional as well as personal interest to power engineers. Here's a book that can be read in an hour or two.

Heat Balance

(*Continued from page* 91)

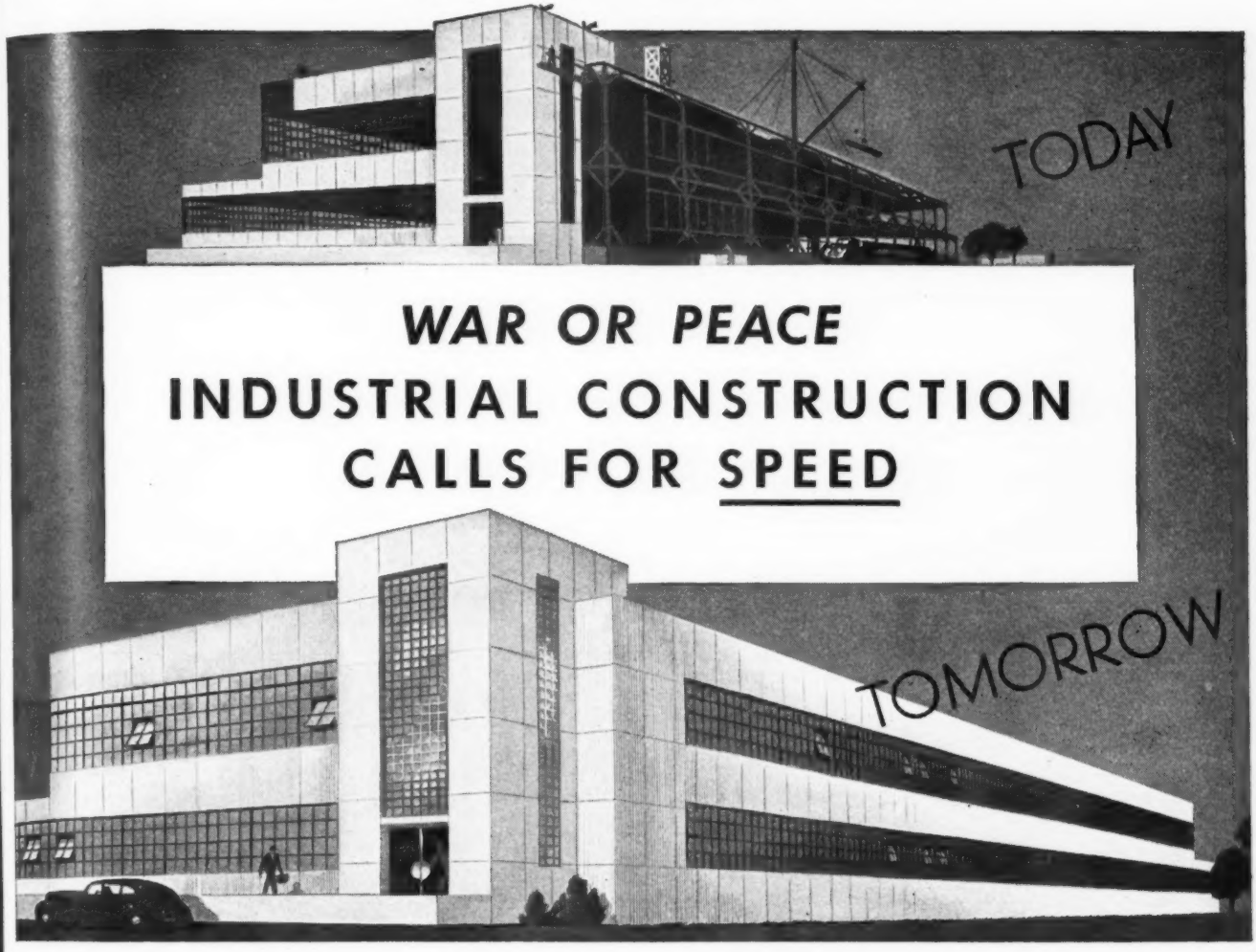
tent of the water leaving this condenser is:

Heat content of feedwater entering condenser plus

$$\frac{\text{lb per hr of steam to ejector} \times 1300}{\text{lb per hr of feedwater through cond}}$$

7. When the steam required for each heater is calculated, we will have

Looking ahead with Asbestos



ONE of the most put-to-work materials in this period of unparalleled war construction has been—and is—K&M "Century" Asbestos-Corrugated and Flat Lumber.

Here's reason number one why Army and Navy air bases and vital war plants have made vast use of this Keasbey & Mattison building material for roofs and sidewalls: Its erection speed is up to the terrific tempo of a desperate war. An advantage which will surely find wide favor in post-war construction.

Besides this all-important speed factor, "Century" Asbestos-Corrugated and Flat Lumber resists fire and water, is rot-and-rust proof, seldom needs repairs or protective treatment, grows tougher with age.

These are outstanding qualities for a building material to possess, whether the construction is for war or peace. When the war is over, and K&M "Century" Asbestos-Corrugated and Flat Lumber can flow again into peace-time channels, Industry will be eager to give it much to do. Just as Industry will also find use for those new products which K&M's intensive research into asbestos will develop.

* * *

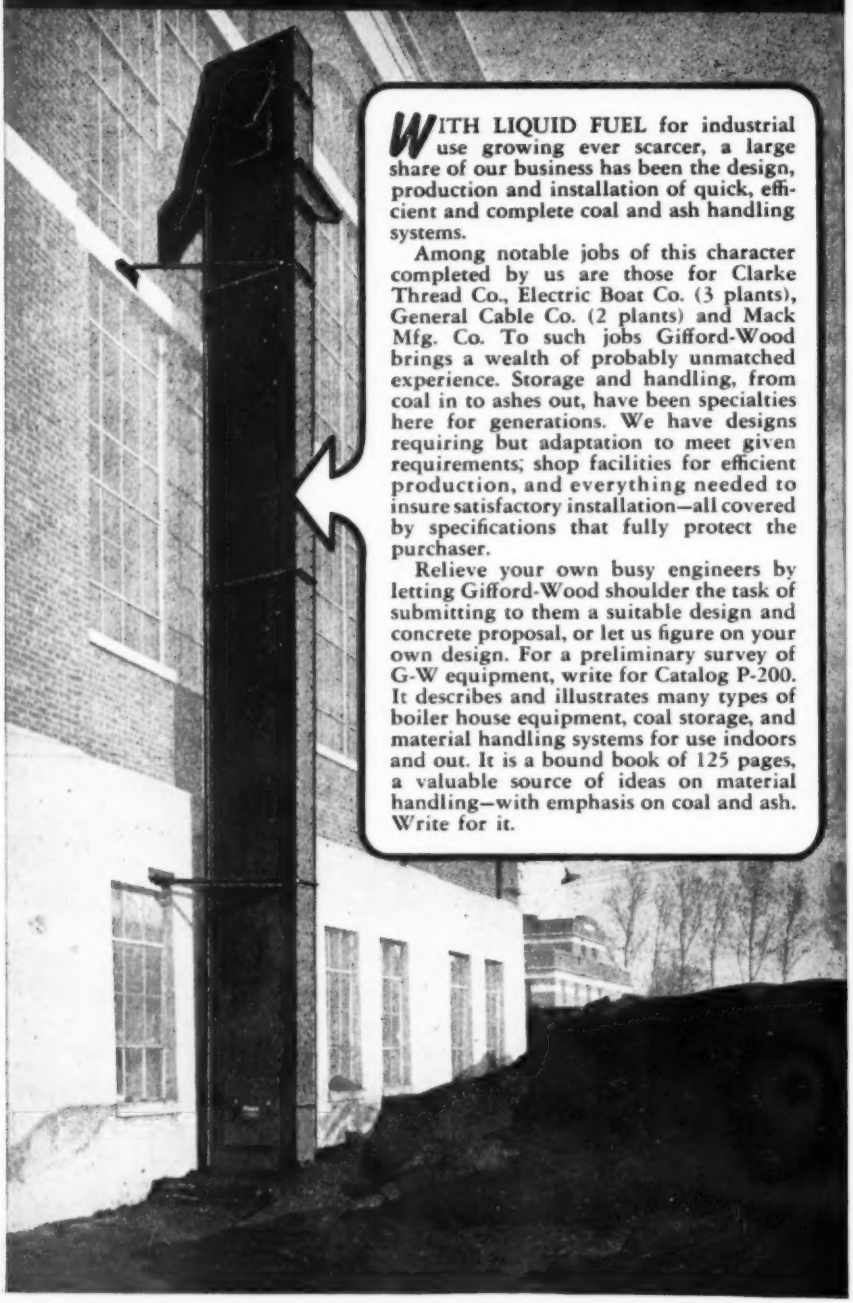
Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

For QUICK CONVERSION to COAL come to GIFFORD-WOOD



WITH LIQUID FUEL for industrial use growing ever scarcer, a large share of our business has been the design, production and installation of quick, efficient and complete coal and ash handling systems.

Among notable jobs of this character completed by us are those for Clarke Thread Co., Electric Boat Co. (3 plants), General Cable Co. (2 plants) and Mack Mfg. Co. To such jobs Gifford-Wood brings a wealth of probably unmatched experience. Storage and handling, from coal in to ashes out, have been specialties here for generations. We have designs requiring but adaptation to meet given requirements; shop facilities for efficient production, and everything needed to insure satisfactory installation—all covered by specifications that fully protect the purchaser.

Relieve your own busy engineers by letting Gifford-Wood shoulder the task of submitting to them a suitable design and concrete proposal, or let us figure on your own design. For a preliminary survey of G-W equipment, write for Catalog P-200. It describes and illustrates many types of boiler house equipment, coal storage, and material handling systems for use indoors and out. It is a bound book of 125 pages, a valuable source of ideas on material handling—with emphasis on coal and ash. Write for it.

3655

GIFFORD-WOOD CO.

FOUNDED 1814

420 Lexington Avenue
New York

HUDSON, N. Y.

565 W. Washington Street
Chicago

Ash Spouts • Barge Unloading • Bins • Boiler House Equipment • Buckets • Bunkers • Carriers • Chutes
Conveyors • Crushers • Elevators • Feeders • Gates • Ground Storage Systems • Hoists • Hoppers
Infra-Red Drying Systems • Screens • Silo Storage Plants • Tanks • Weigh Larries

160 (211c)

steam flows from each bleed point and therefore for each blade group. This will differ from (*D-7*).

8. Determine energy generation for each blade group:

$$\frac{(D\text{-}14)\text{ for each group} \times (E\text{-}7)\text{ for each group}}{3413} = \text{kw}$$

9. Determine power developed by turbine as the sum of all items in (*E-8*).
10. Determine internal power required to drive generator as:

$$\frac{\text{kw rating}}{\text{elec eff} \times \text{mech eff}} = \text{internal kw}$$

11. Divide (*E-10*) by (*E-9*) and use result as a multiplier to correct all steam flows above in case answer is not 1.00.
12. Using the corrected quantities rework until (*E-11*) becomes 1.00 with correct bleeder pressures.

To calculate the heat content at turbine bleed point repeat D:

1. Determine straight condensing flow (Table II) and losses.
2. Stages are given above as four.
3. Select final feedwater temperature (curves 1-5).
4. Determine total flow (curves 6-8) and (*D-1*) = ejector steam plus makeup.
5. Determine total steam bled for feed heating (curves 9-11) and (*D-4*).
6. Determine flow to each heater $\frac{(D\text{-}6)}{4}$
7. Determine flow through each blade group.
8. Determine absolute pressure at each bleed point.
9. Determine entropy of steam beyond throttle and governor valves.
10. Determine theoretical heat drop on the basis of constant entropy for each blade group.
11. Determine energy for each blade group on the basis of (*D-10*) and Table III.
12. Determine heat content of bled steam.
13. Determine heat drop for each blade group.

To calculate heat-balance diagram quantities, repeat E:

1. Draw diagram and label all equipment with temperatures, pressures, heat contents and quantities calculated up to this point based on steps *A* to *D* inclusive.
2. Calculate flows to and from high-pressure heater.
3. Same as (*E-2*) for evaporator, on the basis of 1½% makeup, and same as (2) for medium pressure heater.
4. Calculate flows to and from open heater.
5. Calculate heat use in air ejector condenser.
6. Same as (*E-4*) for low pressure closed heater.

YOU CAN BANK ON FAIRBANKS

for Bronze Globe, Angle and Cross Valves

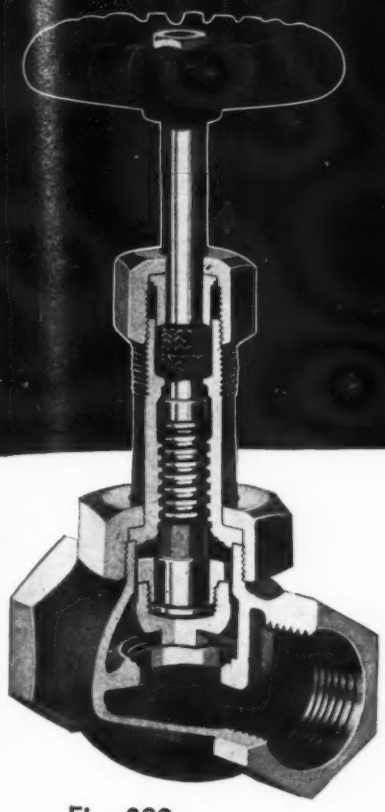


Fig. 029

TIME-TESTED AND SERVICE PROVED

SERVICE: Recommended for applications on steam, water, oil, gas and air. Available for steam working pressures from 125 to 350 lbs.

TYPES: Fairbanks Valves are made with Bronze, Nickel Alloy and Renewable Composition Discs in Plug and Regrinding types. with Union, Screwed-in and Bolted Bonnet.

FEATURES: The valves illustrated have a bronze seat and disc which can be reground if they become worn, without removing the valve from the pipe line. They can be easily dismantled and re-assembled because of the union bonnet. Stem has full-cut Acme threads. Stuffing box is deep and valves can be repacked under pressure when wide open. All parts are interchangeable, except stem.

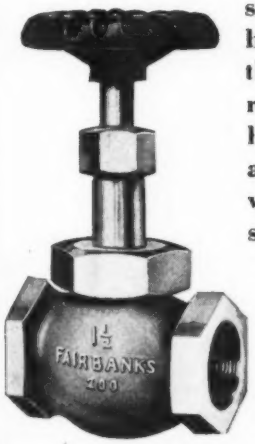


Fig. 029

Fig. 031

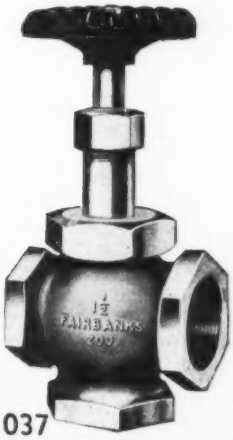


Fig. 037

OTHER FAIRBANKS VALVES

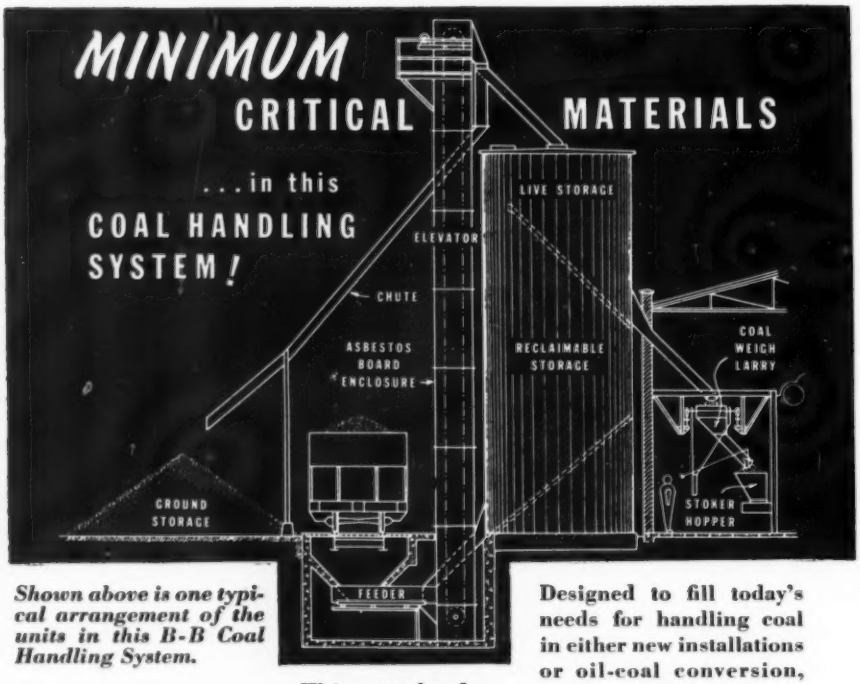
Bronze Globe, Gate, Angle Cross and Check Valves
Iron Globe, Gate, Angle, Cross and Check Valves
Faircoseal Bronze Valves
U-Bolt Gate Valves
Asbestos Packed Cocks
Bronze Radiator Valves
Sphero Ball Valves

CONSULT FAIRBANKS NEW CATALOG No. 42 FOR DETAILS

THE FAIRBANKS COMPANY

393 LAFAYETTE ST., NEW YORK, N. Y.
BOSTON, MASS. PITTSBURGH, PA.

Distributors in Principal Cities



Shown above is one typical arrangement of the units in this B-B Coal Handling System.

Write us today for complete details.

Designed to fill today's needs for handling coal in either new installations or oil-coal conversion, this system offers numerous advantages. Send for full information.

BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS

PATCH FLOORS
. . . while Traffic Rolls

Roll a drum of INSTANT-USE over to the hole in the floor—remove the lid—shovel out enough to fill the hole—tamp smooth—and open the spot to regular traffic immediately, without waiting. You'll have a tough, solid, permanent patch that formerly took 24 hours to get. This rugged, new plastic bonds tight to old concrete, withstands extreme loads. Keep a drum on hand. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER and Details of
FREE TRIAL OFFER

INSTANT-USE
FLEXROCK CO., 2377 Manning St., Phila., Pa.

HERCULES
Seamless Copper
FLOATS

GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

7. Calculate heat rate:

$$\frac{\text{heat at throttle-heat in feed} \times (D\text{-}4)}{25{,}000 \text{ (rating of unit)}} = \text{heat rate}$$

8. Using steam flow and heat drops of (*D-13*) for each blade group calculate power generation in each group.

$$\frac{\text{flow} \times \text{heat drop}}{3413} = \text{kw}$$

9. Add together power generated by each group of blades to get total internal kw generated.
10. Determine internal power required for full output of generator:

$$\frac{\text{kw rating}}{\text{elec eff} \times \text{mech eff}} = \text{kw}$$

11. Divide (*E-10*) by (*E-9*) to obtain flow corrections.
12. If (*E-11*) is not 1.00, rework flows and pressure until they do become 1.00 by applying multiplier obtained to steam flows and heat rates and change pressures accordingly.

Bibliography

Table 1: Westinghouse Notes and Data Book for 1936 and 1939.

Table 2: "Determining Efficiencies for Units 10,000 to 60,000 KW," POWER, January 1937, by Norris D Gove, Turbine Engineer, Westinghouse Electric & Mfg. Co., Essington, Pa.

Curves 1 to 12: These represent the most up-to-date information released by R L Reynolds, Turbine Engineer, Westinghouse Electric & Mfg Co, Essington, Pa.; the author gratefully acknowledges Mr. Reynolds' assistance in allowing their use in this article.

Also see: "Calculation of Gain from Feed Water Heating" in April, May and June, 1929, *The Electric Journal* by R L Reynolds and "The ABC's of Feed Heating" in January, 1940 POWER by Norris D Gove, Turbine Engineer, Westinghouse Electric & Mfg. Co, Essington, Pa.

New Power Construction

Construction To Come

Arkansas—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing plant facilities. Over $1,000,000. Lion Oil Co, El Dorado, will operate.

Arkansas—State Agricultural & Industrial Comm, c/o H K Ferguson, Little Rock, plans constructing wood plastic plant. $1,500,000.

California—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., soon lets contract constructing mill. $1,500,000 incl equipment. P E Jeffers, 816 W 5 St, Los Angeles, engr. Industrial company will operate.

Connecticut—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant expansion. Over $2,300,000. Industrial company will operate.

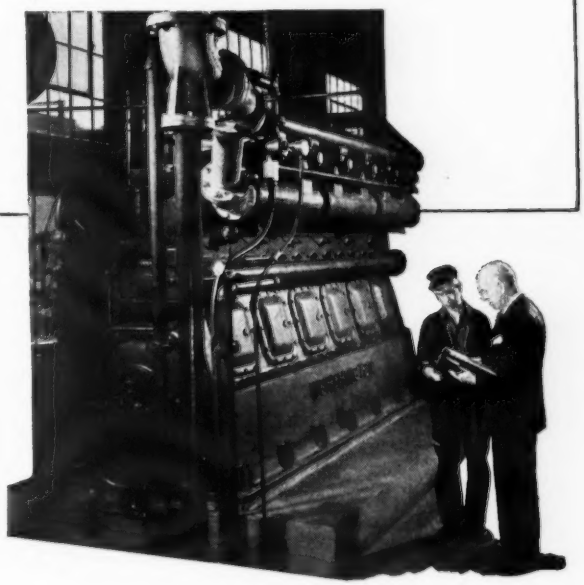
Fla., Jacksonville—Bids Feb 18, by O Z Tyler, supt Municipal Electric Plant, constructing fan ducts for 1500 hp boilers at plant.

Illinois—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing addnl plant facilities. $16,900,000. Chrysler Corp, 341 Mass St, Detroit, Mich, will operate.

At the front

in the war on wear–

Gulf Diesel Oils have greater stability and stamina . . . provide better lubrication under today's peak-load and over-load conditions.



Actual photo of a Gulf Lubrication Service Engineer consulting with power plant engineer on Diesel engine lubrication. After 25,000 hours with Gulf Diesel lubricating oil in service in this Worthington Diesel, cylinder wear totals only .005 inches.

THE peak-load and over-load operating conditions of today have greatly multiplied the problem of avoiding excessive wear of Diesel cylinders, pistons, and bearings. Now, more than ever, it pays to use lubricating oils that provide an extra margin of protection to these vital parts.

You insure this kind of protection when you put Gulf Diesel oils in service to lubricate your units. For built into these quality oils is greater stability and stamina—they stand up and provide a tough film of highest lubricating value that keeps friction at a minimum even under severe operating conditions—conditions which often put units out of service for overhauls and repairs.

Gulf Diesel oils have made outstanding performance records in many plants. After 25,000 hours with Gulf Diesel oil in service in a paper mill unit, for example, cylinder wear totals only .005 inches.

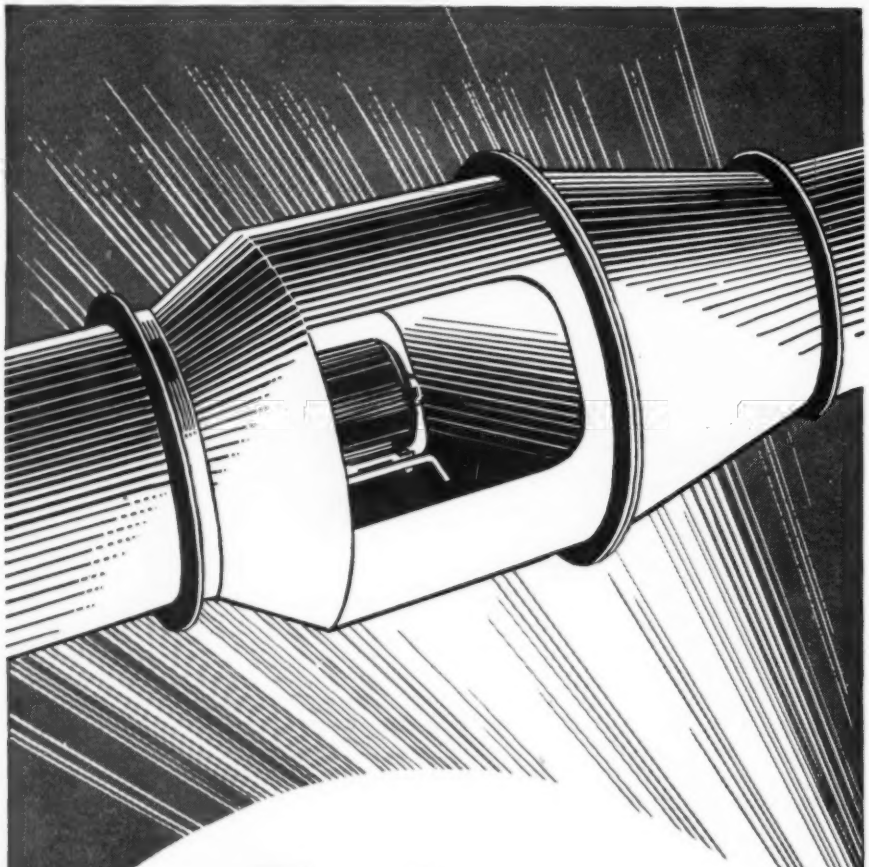
For higher operating economy and less "down-time" in your plant, take this step today: Call in a Gulf Lubrication Service Engineer and ask him to recommend the proper type and grade of Gulf Diesel lubricating oil to fit your particular requirements. His thorough training and broad practical experience with all types of Diesel engines is your assurance of sound and helpful recommendations.

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh, Pa.

FOR VICTORY BUY UNITED STATES WAR SAVINGS BONDS AND STAMPS

GULF INDUSTRIAL LUBRICATION



To keep danger moving

IN chemical, industrial and ordnance plants, DeBothezat Bifurcators keep dangerous corrosive and high temperature fumes moving swiftly through the exhaust ducts. The famous "Axial-Flow" pressure fan which moves the fumes has a non-overloading power characteristic for protection against costly motor failure. The motor is located in a through-ventilated chamber isolated from fumes and readily accessible. Bifurcators install right in the duct in any position from horizontal through vertical. Available in a wide range of sizes and capacities. Details on request.

De Bothezat

VENTILATING EQUIPMENT

Division of American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

Illinois—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing plant, Madison Co, $13,000,000. Standard Oil Co of Indiana, Woodriver, operating-lessee.

Indiana—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant remodeling, addn $4,000,000. Industrial company will operate. Allen & Kelley, 435 Architects & Builders Bldg, Indianapolis, engrs.

Kentucky—Reynolds Metals Co, 2500 S 3 St, Louisville, plans constructing plant addn. $1,500,000 not incl equip. Federally financed.

Ky., Bowling Green—Ken-Rad Tube & Lamp Corp, Bowling Green, plans constructing plant, W 10 St. $900,000.

Michigan—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing addnl plant facilities. Over $2,000,000. Sealed Power Corp, Sanford and Keating Sts., Muskegon, will operate.

Minnesota—Defense Plant Corp, 811 Vermont Ave N W., Wash., D. C., plans constructing blast furnaces, office bldg, boiler and pump house, $1,000,000. Industrial Company will operate.

Missouri—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant. About $2,000,000. Industrial company will operate. Sanderson & Porter, 52 William St, New York, N. Y., engrs.

New York—Defense Plant Corp., 811 Vermont Ave, N W, Wash., D. C., plans constructing boiler plant. $125,000. A D Crosett, 512 S Ave, New York, engr.

Pa., Johnstown — Johnstown Traction Co, Johnstown, plans constructing power sub-station addn, incl purchase, installation two new motor generated sets. $40,000.

Texas and Indiana—War Emergency Pipe Lines, Inc, Beaumont, Tex., plans constructing 60 electrically operated pump stations along 836 mi 20-in. pipeline carrier between Beaumont-Rouston, Tex. to Seymour, Ind. $2,000,000.

Texas—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans construction and completion plant addn $2,000,000. Industrial company, lessee.

Texas—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant expansion for industrial company. $1,250,000.

Wisconsin—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant facilities. Over $22,000,000. A O Smith Corp, 3533 N 27 St, Milwaukee, will operate.

Wisconsin—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing plant extens. Over $2,500,000. Kohler Co, Kohler, will operate.

Wisconsin, Illinois and Iowa—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans installing equipment, conversion plants in above states. Over $2,500,000. J I Case Co, Racine, Wis., will operate.

Contracts Let

Conn., Cos Cob—New York, New Haven & Hartford R. R, E E Oviatt, ch. engr, Water St, New Haven, awarded contract impry power plant, to Gibbs & Hill, Inc, Penn Station, New York, N. Y. Est $500,000.

Florida—U. S. Eng. U. S. Courthouse & Post Office, Jacksonville, awarded contract constructing bldg and steam plant, Hillsborough Co, to R E Clarson, Inc, Power & Light Bldg, St. Petersburg, less than $500,000.

NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library up to Date

For Your Convenience

Two business-reply cards are printed here as a part of this insert. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for four to eight pieces, use both attached cards.

2. Be sure to fill one of the eight spaces for each piece you order. This will assure your receiving copies of literature promptly by reducing amount of clerical work in handling your request.

3. When you have filled out one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail. No postage is required.

Example

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co.

Address 318 First Avenue
Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

Please fill out *each section* of the coupon *completely*, for each bulletin you wish. Coupons not completely filled out will not be handled. These cards void after June 1, 1943.

BOILERS AND ACCESSORIES

1 REFRACTORIES—Ironton Fire Brick Co, Ironton, Ohio. 4-page leaflet covers Ironton line of foundry refractories including cupola blocks, ladle-pouring brick, ladle bottom tile and cupola specialties. Also gives photographs, diagrams, dimensions and specifications.

ELECTRICAL EQUIPMENT

2 RHEOSTATS—Ward Leonard Electric Co, Mount Vernon, New York. 16-page bulletin No. 60A describes Vitrohm and Ribohm field rheostats and accessories with photographs, diagrams, tables of specifications and prices. Also lists spare parts available.

3 ELECTRICAL CONTROLS—Square D Co, Dept 30, 4041 North Richards St, Milwaukee, Wis. Complete catalog carries detailed descriptions and engineering information on devices including circuit breakers, switches, relays, contactors, and special-purpose devices.

4 SWITCHGEAR — Allis-Chalmers Mfg Co, Milwaukee, Wis. Bulletin No B6185, 20 pages, contains descriptions and illustrations of all indoor and outdoor switchgear with removable or fixed circuit breakers. Also reviews latest developments, including air-blast circuit breaker, and switchgear as part of new factory-assembled unit substations.

5 CIRCUIT BREAKERS—Westinghouse Electric & Mfg Co, Dept 7-N 20, East Pittsburgh, Pa. 40-page spiral-bound book, covers complete line of Nofuze "De-Ion" circuit breakers for lighting, distribution and power circuits up to 600 amp. Also describes special attachments including shunt trip, undervoltage release, auxiliary switches, and bell-alarm switches.

6 SUBSTATIONS—General Electric Co, Schenectady, N. Y. 36-page catalog GEA-3800 describes the Master unit substations, said to be safe, complete, reliable, coordinated and easy to install.

HEATING, VENTILATING & AIR CONDITIONING

7 REFRIGERATION — Frick Co, Waynesboro, Pa. Bulletin No. 530-A, 8 pages, entitled "Frick Refrigeration Afloat" reviews refrigeration uses on battleships, liners, perishable-cargo boats,

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

Write in circle number of item describing one catalog wanted → ( )

Your Company Name.....

Address .....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 3-43

freight and passenger steamers, tankers, tugs, and submarines. Booklet contains many photographs.

8 VENTILATOR—Young Radiator Co, Racine, Wis. 4-page folder, No. 2942, introduces the Young Vertivent, combination forced-air and blackout-air control unit for industrial plants, said to be well adapted to structures already erected and easily and quickly installed.

MATERIALS HANDLING

9 MATERIALS HANDLING—Robins Conveying Belt Co, Passaic, N. J. 24-page bulletin No. 121 outlines Robins Mead-Morrison handling machinery for coal, ore and other bulk materials, such as man trolley and rope system bridges, cable railways, car dumpers, grab buckets, towers, rail clamps and special rigs, with photographs and diagrams.

10 MATERIALS HANDLING—Whiting Corp, Harvey, Ill. 24-page bulletin No. 236 outlines features of company's products including cranes, railroad and aviation equipment, cupolas and foundry equipment, evaporators and filters and other special equipment for heavy industries.

11 WOOD SHEAVE—Dodge Mfg Corp, Mishawaka, Ind. 12-page bulletin A-333 B introduces Dodge Victory wood sheave that saves metals for tanks, ships, guns and planes. This sheave is offered not as a substitute but as an alternate for metal sheaves.

MECHANICAL TRANSMISSION

12 GEAR JOINTS—Piezoelectric Laboratories, 110 East 42nd St, New York, N. Y. 4-page folder describes Piezo universal gear joints stressing (1) gears hinge, (2) joints operate at angles up to 92-deg, and (3) maximum turning force. Also contains photographs, diagrams and specification tables.

13 CHAINS AND SPROCKETS—Ramsey Chain Co, Inc, Albany, N. Y. 64-page spiral-bound catalog on Ramsey chains, sprockets and couplings contains engineering data on design and application of Ramsey silent chain drives and flexible couplings with list prices.

All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ POWER TRANSMISSION — Dodge Mfg Corp, Mishawaka, Ind. 388-page manual No. 42 contains complete descriptions, diagrams, dimensions, and prices of thousands of power transmission appliances with over a hundred pages of essential engineering data for design, installation and operation of mechanical power drives.

METERS, INSTRUMENTS & CONTROLS

14 THERMOMETERS—Wheelco Instruments Co, Harrison and Peoria Sts, Chicago, Ill. 12-page Bulletin G-32-2 discusses operating principle of Wheelco thermometers and offers information to aid user select proper instrument for his application. Table gives details on characteristics, performances, limitations of each class of vapor-pressure and gas-filled instruments.

15 DRIVE CONTROL—Westinghouse Electric & Mfg Co, Dept 7-N-20, East Pittsburgh, Pa. 14-page booklet B-3122 introduces Rototrol, dc drive control for use where wide speed range or close regulation is required. Charts, diagrams and photographs explain how Rototrol regulates by transposing mechanical and electrical quantities. Typical applications described and illustrated.

16 CONTROLS—Bristol Co, Waterbury, Conn. Binder contains series of bulletins on automatic-control instruments for industrial furnaces, kilns and ovens. These have been bound in loose-leaf form so that additions and revisions may be inserted. Bulletins illustrated with photographs, application drawings, and wiring diagrams.

17 THERMOMETERS—Wheelco Instruments Co, Harrison and Peoria Sts, Chicago, Ill. 8-page catalog No. G-503-2 features company's recording control thermometer and covers the "electronic principle" of effecting control without mechanical contact between measuring and control sections of instruments. Also includes schematic drawings.

18 PACKING—Gits Brothers Mfg Co, 1846 South Kilbourn Ave, Chicago, Ill. New bulletin presents latest detailed information, recommendations, applications, diagrams, listings, and prices on line of Gits Oilseals and Greaseals.

19 SYNCHRONOUS-MOTOR CONTROL—General Electric Co, Schenectady, N. Y. 12-page booklet describes starting, accelerating, synchronizing, normal running, pull-out and undervoltage protection as performed by magnetic and semi-magnetic full- and reduced-voltage synchronous-motor controls. Also listed and described are several metal cabinet-type enclosures for protecting these controls.

20 CONTROLS—Hotstream Heater Co, 8007 Grand Ave, Cleveland, Ohio. 16-page manual "Selecting Controls for Fuel Conservation" covers natural-draft coal burning, automatic stoker firing, chain-grate and spreader-stoker operation, forced-draft hand firing, and natural-draft oil burning. Each installation illustrated with drawings.

PIPING, VALVES AND FITTINGS

21 VALVE OPERATOR — Automatic Temperature Control Co, Inc, 34 East Logan St, Philadelphia, Pa. 4-page catalog A4 covers Type 2 valve operator and lists applications, design features and functional data. Also includes electrical and mechanical details, diagrams and tables, dimensions, valves and general specifications.

22 VALVES—Okadee Co, 332 South Michigan Ave, Chicago, Ill. Catalog No. 40, 16 pages, lists Okadee valves for power-plant, industrial and marine service with photographs, diagrams, dimensions and specifications. Also includes typical installation photographs.

(*Continued on page* 168)

FIRST CLASS
PERMIT No. 10
(Sec.510,P.L.&R.)
NEWYORK,N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid By—

POWER
330 West 42nd Street
New York, N. Y.

FIRST CLASS
PERMIT No. 10
(Sec.510,P.L.&R.)
NEWYORK,N.Y.

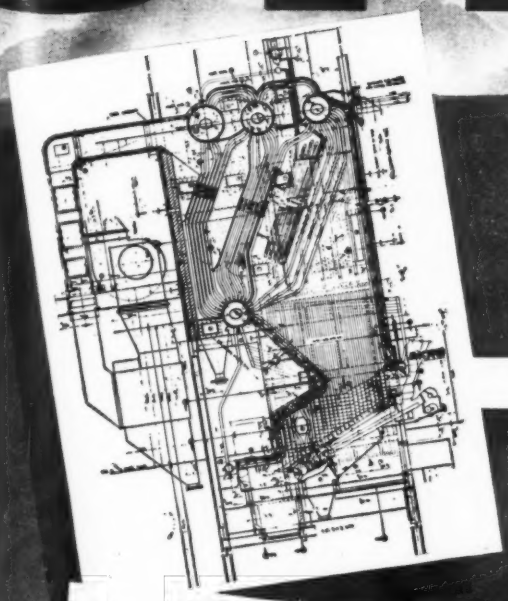
BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid By—

POWER
330 West 42nd Street
New York, N. Y.

STEAM

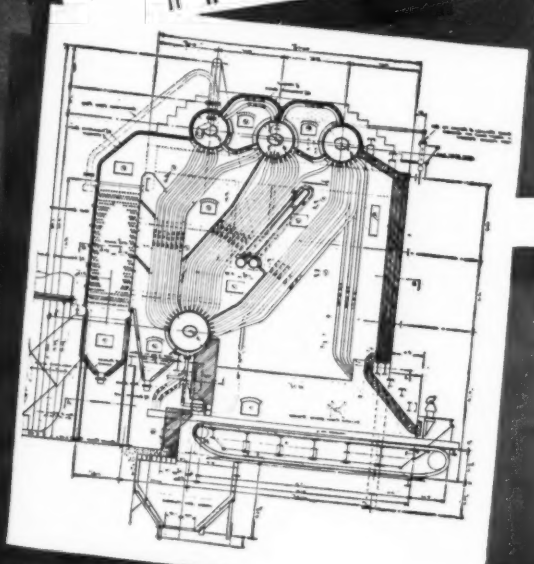
for



POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

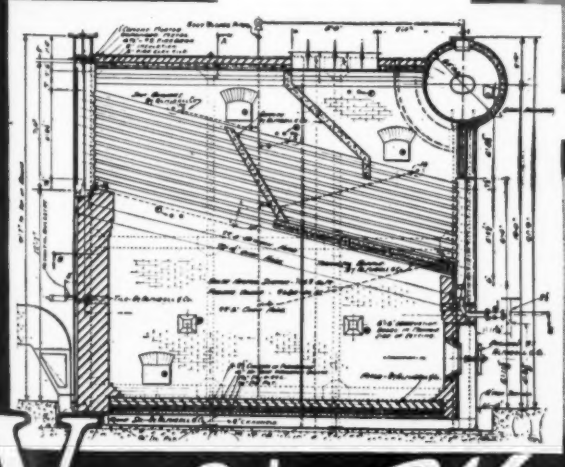
90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.



PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.



HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY

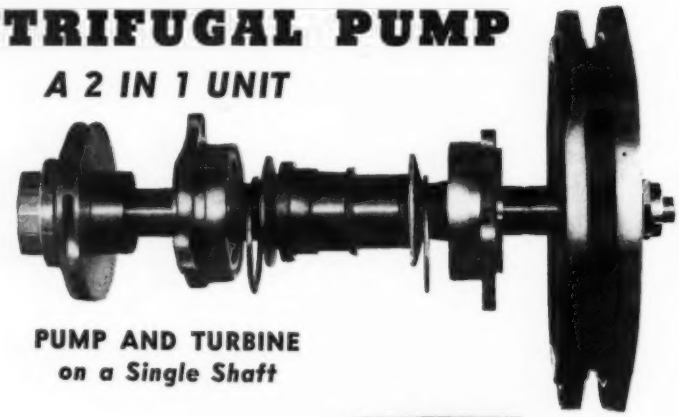
Branch Offices: NEW YORK CLEVELAND CHICAGO PHILADELPHIA DALLAS

Vogt *Water Tube* BOILERS

BENT TUBE AND SECTIONAL HEADER TYPES

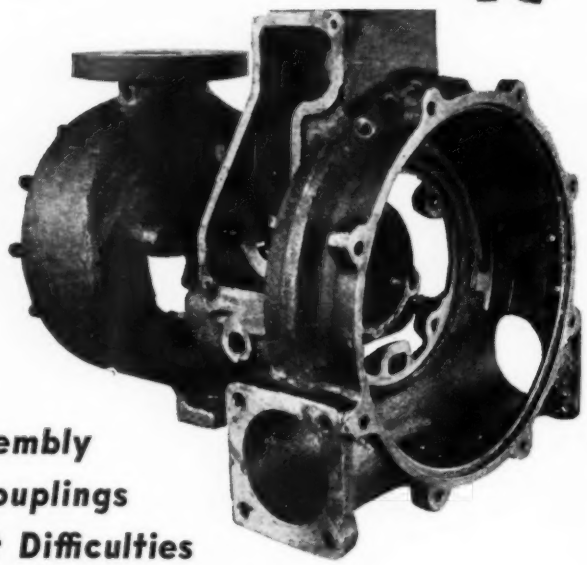
COFFIN—Steam Turbine CENTRIFUGAL PUMP

A 2 IN 1 UNIT



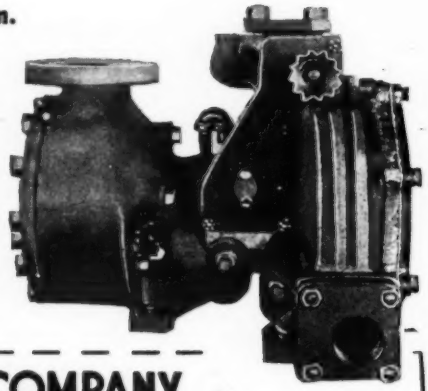
PUMP AND TURBINE
on a Single Shaft

ENCASED IN STEEL



- ✓ *Saves Space*
- ✓ *Easy End Assembly*
- ✓ *No Driving Couplings*
- ✓ *No Alignment Difficulties*
- ✓ *Minimum of Bolted Connections*
- ✓ *Maximum Strength and Safety*

PRESSURES TO—750 Lbs. per sq. in.
DELIVERIES TO—500 G.P.M.



Mail the Coupon

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

Please Send Descriptive Bulletin I-21

NAME

COMPANY

ADDRESS

P.W.

New Bulletins

(*Continued from page 166*)

23 UNDERGROUND PIPING—A. M. Byers Co, Pittsburgh, Pa. New bulletin entitled "Wrought Iron for Underground Services" discusses most important factors effecting soil corrosion of underground piping, weighs theory against test results and outlines installation histories of water, oil and gas wells and lines, gasoline lines and tanks and electrical cable conduit.

23A VALVES—Jenkins Bros, 80 White St, New York, N. Y. 32-page booklet entitled, "Where to Use Valves, Drains and Bypasses", tells which valve to use, differences between various valves, fundamentals of valve designs and applications, where to use bypasses or drains, metal composition of Jenkins valves and lists ASME Power Boiler Code valves.

PRIME MOVERS

24 DIESELS—Witte Engine Works, Kansas City, Mo. 20-page book outlines Witte diesel engines and dieselectric plants with photographs, diagrams, descriptions, specification tables and also an insert which contains fuel consumption tables, fuel curves, power curves, etc.

25 RING JOINTS—American Locomotive Co, 30 Church St, New York, N. Y. 8-page catalog, No. 1032, describes Alco clamp ring joints used on heat exchangers, with special emphasis on fact that these joints reduce weight of steel necessary up to 15%, and in this way contribute to the war effort.

26 GAS ENGINES—Worthington Pump and Machinery Corp, Harrison, N. J. 8-page bulletin No. S-550-B21 covers CCG gas engines, vertical, 4-cycle, totally enclosed, adaptable to generator, pump, compressor and other power drives. Also includes typical installation photographs.

27 FUEL INJECTION—Ex-cell-o Corp, Detroit, Mich. 4-page folder No. 391221 outlines company's fuel-injection equipment for diesel engines in industrial, marine and automotive service, with special emphasis on fuel-injection pumps and nozzles. Includes numerous photographs of various parts.

PUMPS

28 PUMPS—Layne & Bowler Inc, Memphis, Tenn. 32-page bulletin covers complete line of vertical turbine pumps with diagrams, sizes and capacities, applications, and installation photographs. Book also contains ten pages of useful engineering information.

29 PUMPS—Economy Pumps Inc, 1000 Weller Ave, Hamilton, Ohio. Pump handbook, 256 pages, contain all data necessary for solution of ordinary pump problems. Subjects covered include: pump operation and installation, determination of pump capacities, hydraulic data and operating costs.

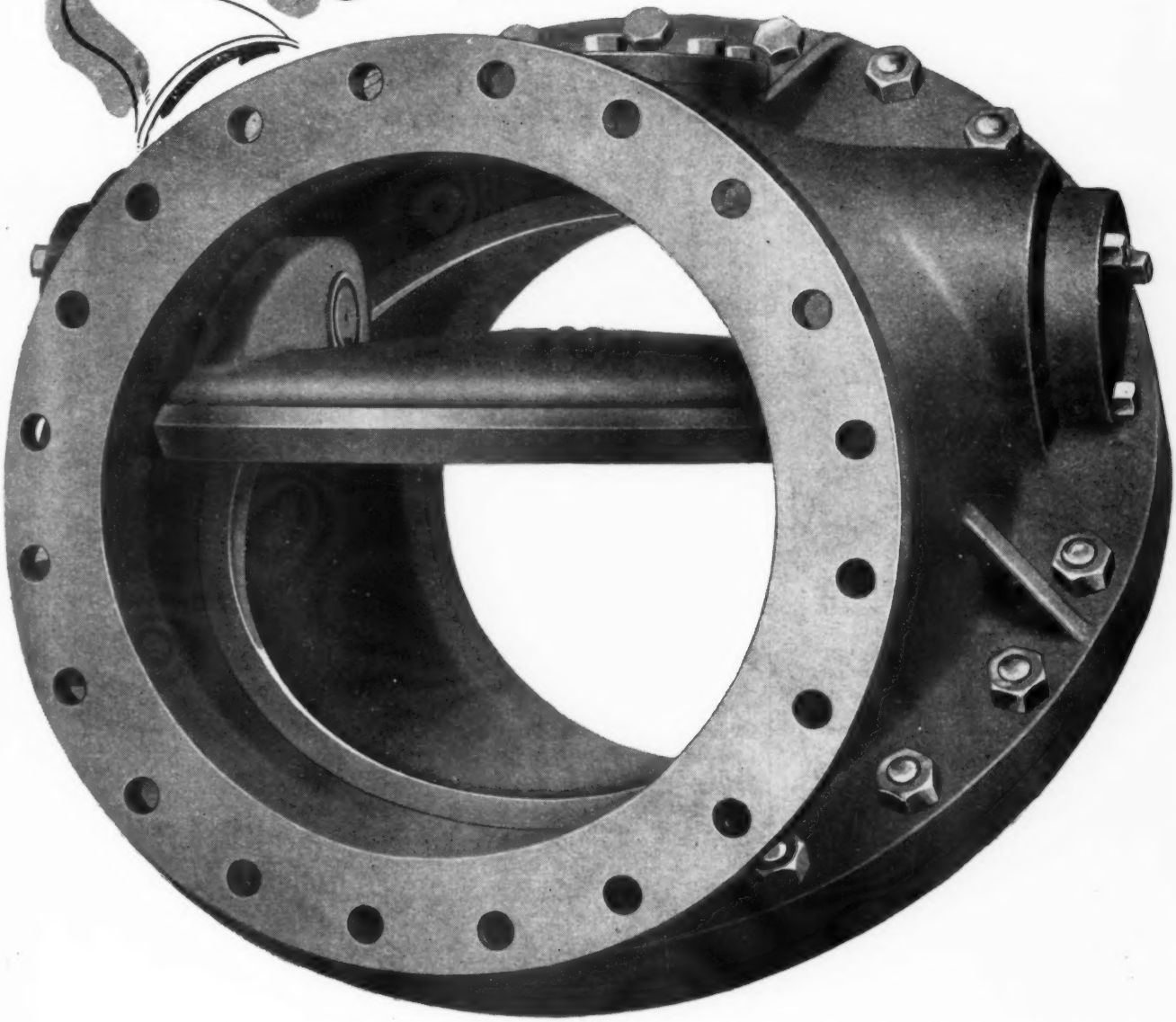
30 PUMPS—Warren Steam Pump Co, Warren, Mass. Bulletin No. 230 describes and illustrates type DBH single-stage, double suction pumps with special features, specifications, sectional views, rating table and dimensions. Also includes typical pump photograph.

31 PUMPS—Allis-Chalmers Mfg Co, Milwaukee, Wis. New maintenance guide gives specific recommendations for putting pump care on a wartime basis. Step by step, a centrifugal pump is actually built, and as each part is added, the way it is built and functions are seen to determine the way it should be cared for. This manual applies to all pump makes.

32 PUMPS—Economy Pumps, Inc, 1000 Weller Ave, Hamilton, Ohio. 8-page booklet No. D-2-1042 features Economy's new type SCV pump for clear liquid service, 10 to 500 gpm and covers construction, features, advantages, and dimensions with photographs and diagrams.

EVEN IF HE HAD HIS HEARING
HE STILL COULDN'T HEAR A THING

WHEN A CHAPMAN
TILTING DISC CHECK VALVE CLOSES



This valve has a tilting disc of airfoil design, balanced and hinge-pinned so that . . . as flow slows down . . . there is a gradual cushioned closing that terminates *silently* in a drop-tight seating of the disc. You get no slam, no vibration, no opening of pipe joints . . . and practically no wear at all within the valve itself, so no problems of repair or maintenance. But what you *do* get is a reduction in head loss from 65% to 80% over conventional type checks . . . and a reduction in pumping costs that have run as high as $95 per year per valve. 12-page book gives full engineering data, test results, and installation information. Write for your copy now, to The Chapman Valve Mfg. Co., Indian Orchard, Mass.

CHAPMAN NON-SLAM CUSHIONED CLOSING **CHECK VALVES**

POSITIVE Protection

Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1809. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN

WATER TREATMENT

33 WATER TREATMENT — Graver Tank & Mfg Co Inc, East Chicago, Ind. 24-page catalog No. 314-7500 features hot-process water softeners with numerous installation photographs, cross-sectional and line diagrams, charts and tables. Also contains general engineering data.

34 WATER TREATMENT — Cochrane Corp, Philadelphia, Pa. 8-page reprint No. 23 of an article entitled, "Conditioning Feedwater for High-Pressure Boilers" discusses importance of removal of scale, corrosion, carry-over and embrittlement, and the requirements for high-pressure boilers. Contains many charts and diagrams.

35 WATER TREATMENT —Graver Tank & Mfg Co, Inc, East Chicago, Ind. 12-page booklet discusses Graver pressure type water filters which provide high efficiency in filtration and means of delivering filtered water without repumping after filtration. Many photographs and diagrams illustrate these filters.

WELDING

36 WELDING—Allis-Chalmers Mfg Co, Milwaukee, Wis. 18-page booklet B6049A illustrates successful applications of Weld-O-Tron, new low current dc arc welder capable of welding metal from 3-16-in. down to a minimum of .010-in. (32 gage), throughout industry and the armed forces.

37 WELDING—Westinghouse Electric & Mfg Co, Dept 7-N-20, East Pittsburgh, Pa. 12-page booklet B-3136 describes and illustrates complete line of Flexarc ac welders with current ratings from 100 to 500 amp. Book compares advantages of ac and dc welding.

OTHER EQUIPMENT

38 BLOWERS—Allen Billmyre Corp, 431 Fayette Ave, Mamaroneck, N. Y. 12-page folder No. I-100, describes many types of turbo and rotary blowers and also stationary and portable vacuum cleaners for industrial plants. Also includes photographs of each type.

39 LUBRICATION—Alemite Div, Stewart-Warner Corp, 1826 Diversey Parkway, Chicago, Ill. 50-page catalog features a comprehensive selection guide for determining what equipment is best suited to any lubrication requirements. Also describes stationary and portable power guns, lubricant loaders and transfer pumps, and all types of manually-operating greasing equipment.

All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ DATA BOOK—Revere Copper and Brass Inc, 230 Park Ave, New York, N. Y. Sixth edition of the Revere Weights and Data Handbook, 172 pages, includes a new section giving technical and mill definitions and illustrations of terms used in the copper and brass industry. In addition, chemical and physical properties have been revised, additional formulas have been included and other formulas have been simplified.

40 LUBRICATION—Alemite Div, Stewart-Warner Corp, 1826 Diversey Parkway, Chicago, Ill. 4-page folder discusses new portable Alemite "Lubrikart," compact unit mounted on hand truck, designed to reduce maintenance time to a minimum.

41 LUBRICATION — Nassau Laboratories, Hackensack, N. J. 28-page handbook explains work which graphite performs and lists various products supplied. Book contains indexed list of applications which help lubrication engineer keep machines operating at performance peak.

4 SKIN PROTECTION—Mine Safety Appliances Co, Braddock, Thomas and Meade Sts, Pittsburgh, Pa. 16-page catalog introduces a complete line of safety-engineered creams and lotions which create an effective barrier on worker's skin against industrial dermatitis.

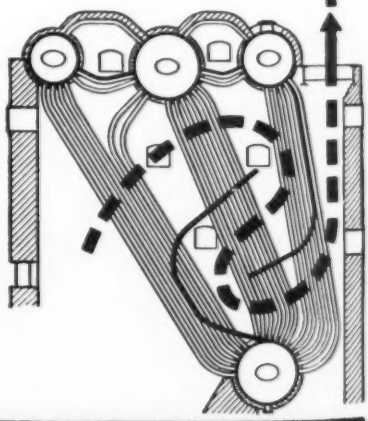
Enco

Extra Power Quickly

...and easily... with these Fuel-Saving Baffles

- Provide cross-flow of gases over tubes for maximum heat-transfer
- Tapered gas passes and curved surfaces streamline the gas flow and maintain gas velocity for efficient heat-extraction
- Draft losses materially reduced by elimination of eddy currents, bottlenecks and dead gas pockets
- Less steam used in cleaning because soot blowers are used less often, and more effectively
- Applicable to any design of water-tube boiler, fired by any fuel
- Each installation is designed on the basis of 25 years experience in this specialized branch of engineering
- Installed by skilled mechanics

Ask for bulletin BW 40 giving valuable data on modern baffle-wall constructions — free



THE ENGINEER CO.
Enco 75 West St. New York, N.Y.

How to Get More Life From Worn-out Boilers

If they can pass inspection and a hydrostatic test, APEXIOR will "peg" that condition for more years of good performance.

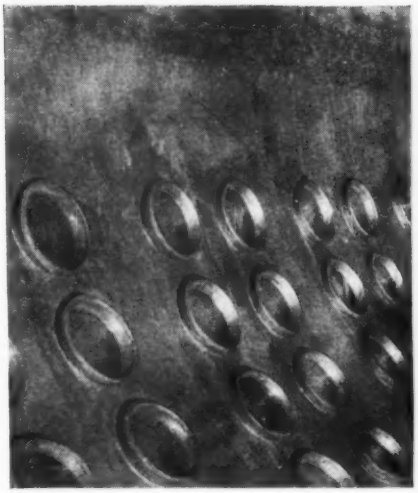
Those boilers nearing the end of their life . . . those boilers already on the inactive list — there's an excellent chance you can get more years of work out of them by APEXIORIZING.

Any boiler that can withstand the required hydrostatic pressure is good for plenty of hard service — if the test strength of the metal is maintained by a durable coating of APEXIOR.

APEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand or power-coater. It fills in the metal pores and joints and forms an impenetrable barrier against water. There is less adherent scale, so scale removal is made easy (with a wire brush) . . . and less often required.

Hundreds of operators have used



APEXIOR for years as an economical means of boiler maintenance. Hundreds more have recently adopted APEXIOR as a guarantee of longer life for metal that cannot be replaced.

An APEXIOR coating will last 2 or 3 years, often longer. It is easily renewed. Save *your* boiler metal from wear and damage that cannot be measured in dollars. APEXIORIZE — and keep boiler metal young.

Easy to Apply — Easy to Maintain — Bulletin 1290 Gives Facts on a Paint that Gives Metal New Life.

ENGINEERING SALES REPRESENTATIVES

Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty St., New York, N. Y.

Users like these have applied APEXIOR for years.
APEXIOR will help YOU get more service from irreplaceable equipment.

U. S. Coast Guard
Westinghouse Elec. & Mfg. Co.
Illinois Central Railroad Co.
Standard Oil Co. of N. J.
Bethlehem Steel Co.
Boston Edison Co.
Brooklyn Edison Co.
Carnegie-Illinois Steel Co.
Pacific Gas & Electric Co.
U. S. Navy Department
U. S. War Department
Sun Shipbuilding & Dry Dock Co.

A PEACETIME PLUS · · · A WARTIME MUST

APEXIOR

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The DAMPNEY COMPANY of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

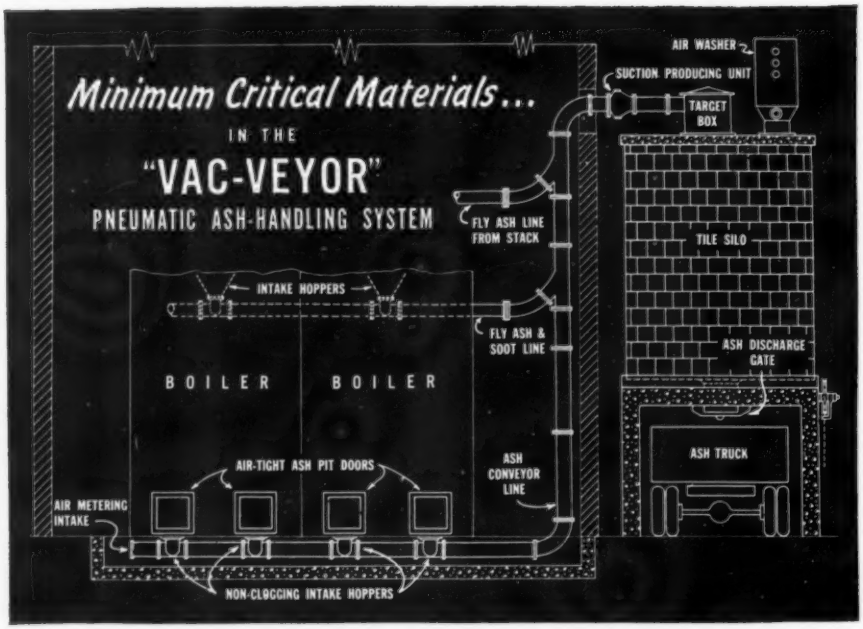
THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.
Please send free Bulletin 1290 to

Name.....

Company.....

Address.....

Main Office: **HYDE PARK** • **BOSTON** • **MASS.** • Branch Offices: **ATLANTA** • **CHICAGO** • **NEW YORK** • **DETROIT** • **PHILADELPHIA**

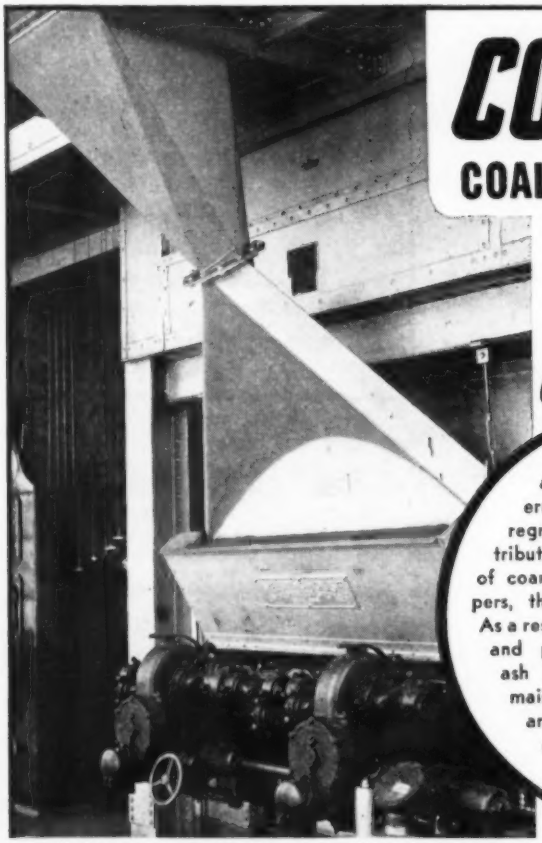


Write us today for complete details

Designed to fill today's needs in either new installations or oil-coal conversion, this pneumatic ash handling system offers numerous advantages.

BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS



CONICAL
COAL DISTRIBUTORS

eliminate coal segregation!

Eliminate fuel losses and difficulties of operation due to coal segregation. Conical Coal Distributors deliver a uniform mixture of coarse and fine coal across hoppers, thus combustion occurs evenly. As a result, the average CO_2 is higher and percentage of combustible ash is reduced, there is less maintenance of stokers and arches and fuel burning capacity is increased.

Write today for additional information.

STOCK ENGINEERING CO. 9807 THEODORE AVE. CLEVELAND, OHIO

43 PAINTS—S C Johnson & Son, Inc, Racine, Wis. 12-page catalog features new wax-fortified paints, specially developed to reduce maintenance costs, which results in increased dirt-resistance, high light values—longer, lower cleaning costs and extra toughness and wear. Also includes sample colors and price list.

44 MOLDED RUBBER GOODS—B F Goodrich Co, Akron, Ohio. 8-page catalog section in question-and-answer form describes rubber molding process, discusses molds and their costs, materials, tolerance limits, attachment of rubber to metals in molding and varied shapes of molded articles. Booklet supplies practical information in use, application and development of rubber parts molded to fit specific industrial requirements.

45 INSULATION VIBRATION — B F Goodrich Co, Akron, Ohio. 12-page booklet discusses Goodrich Vibro-insulators with methods of mounting, application, characteristics, descriptions and engineering data. Also contains photographs, diagrams and charts.

46 PILOT-LIGHT ASSEMBLIES — Gothard Mfg Co, 1300 North 9th St, Springfield, Ill. 8-page catalog covers Gothard pilot-light assemblies for marine, aircraft and industrial applications, with complete range of types and sizes, dimensional diagrams, and list prices.

47 SAFETY—Boyer-Campbell Co, 6540 Antoine St, Detroit, Mich. Catalog No. 50, 134 pages, describes company's line of equipment for accident prevention including face shields, goggles, helmets, respirators, masks, gloves, safety belts, aprons, bandages and other first-aid equipment.

48 LUBRICATION — Lubriplate Div, Fiske Brothers Refining Co, 129 Lockwood St, Newark, N. J. 4-page folder No. 1-43 sets forth information relating to installation, care and lubrication of ball and roller bearings. Also features correct application of lubricants.

New Equipment

(*Continued from page* 132)

varying pressures developed in the cylinder. Output voltages as high as 40 millivolts are obtainable from these pickups when used with the standard CFR gasoline testing engine using 70-octane rating gasoline, said voltage being a total of detonation and regular explosion. *Electro Products Laboratories, 549 W Randolph St, Chicago, Ill.*

Steel Scaffold

SAFWAY is scientifically designed system of steel scaffolding. Basic unit consists of two end frames which, when erected, are held rigidly together by two cross braces. This forms a complete unit 5 ft wide, 7 ft long and 5 ft high. Desired heights obtained by adding similar units to the basic unit through the use of coupling pins. For new plant building, or old plant modernization and maintenance work, "Safway" meets the demands for speedy erection, flexibility of installation and safety of workmen, maker says. Two men can erect 30 vertical feet in 30 minutes. The unit

Neglect is a SABOTEUR

IN THE THOUSANDS of plants which depend on Multiple V-Belt Drives to keep the flow of vital war materiel at flood tide, there may be a saboteur at work effectively slowing down production and wasting precious rubber.

This saboteur is particularly insidious—he can't be seen—nor can armed guards or wire fences keep him out. His name is NEGLECT—neglect of a few simple rules for prolonging the service life of Multiple V-Belt Drives.

You can eliminate this saboteur from your plant by applying the recommendations of the Engineering Research Bureau of the Multiple V-Belt Drive Association. You'll find them in the Association's book on Conservation—prepared and published at considerable expense for the sole purpose of aiding power users win the war on the production front.

MULTIPLE V-BELT DRIVE ASS'N

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

Write for this FREE Association Book Today!

HERE'S THE

FLOW RATE CHART

THAT'S REALLY

EASY TO READ

GET THE WHOLE STORY AT A GLANCE!

Why worry with factors and "micro-scopic" low rate readings when all Simplex MS meters use an evenly spaced chart—with even graduations from 0 to maximum.

WHAT DOES THIS MEAN TO YOU?

1—The direct reading chart with 0 factor only, assures the same high accuracy and ease of reading anywhere in the flow range from minimum to maximum flow.

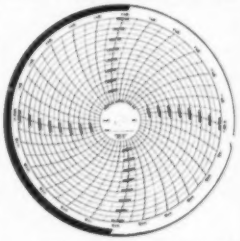
2—Even graduations make it easy to read low as well as high flows from a distance.

3—Greater accuracy of chart readings from planimeter.

4—Extreme accuracy of chart record is inevitable since pen arm connects directly with bell-shaped float.

5—Special moisture proof paper eliminates stretching and shrinkage — chart cannot slip in use.

Simplex has "engineered" the chart on the MS meter as well as every mechanical detail. This direct reading chart is made possible because of the unique bell-shaped float which extracts the square root of the law of flow. Here is accuracy, ease of recording, and ease of reading — yours for the using in every Simplex Type MS meter. There is no finer meter at the price. Specify Simplex MS meters. Write for details today.



12" circular chart for daily or weekly removal. Electric or mechanical clock drive.

SIMPLEX VALVE & METER CO.

6780 UPLAND STREET, PHILADELPHIA, PA.

SIMPLEX

POWER & PROCESS

METERS

THE METER WITH THE BELL SHAPED FLOAT

can be used for both interior and exterior work in iron and steel plants, shipyards, power plants, etc. Unit is light in weight, extremely rigid and extra strong. It occupies minimum space both when erected or when dismantled and stored. All parts interchangeable and may be used over and over again. *Safway Steel Products, Inc, 6228 W State Street, Milwaukee, Wis.*

Generator Relay

GENERATOR DIFFERENTIAL relay, Type CFd, for use in generator protection, is a high-speed, induction-cylinder device, incorporating a new principle called "product restraint" with variable slope characteristics. New combination eliminates the difficulty previously encountered with high-speed generator relays because of the transient current transformer errors on heavy through faults. The relay is 20⅝x5½ in. in the standard 3-element drawout case and can be supplied for a surface or semi-flush mounting. Each element of the relay is of the familiar 8-pole induction-cylinder type. Three poles are used for the differential operating function and three poles provide the "product restraint." *General Electric Co, Schenectady, N. Y.*

Avoid Shutdowns

No more prolonged shutdowns when the new Economy SCV pump is on the job. Stock motors easily adapted in case of motor failure.

Motor high above floor away from dirt and splash.

Minimum floor space.

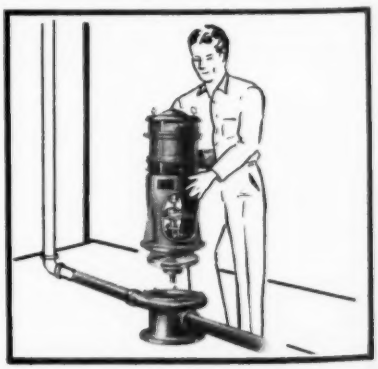
Complete rotor removable without disturbing suction and discharge piping.

Economical—low cost maintenance.

Services from 10 to 500 G.P.M. Heads up to 225 feet.

For cold and hot water circulation, brine, air conditioning, sprinkler systems, boiler feed and pressure boosting, food and other processing, brewing and many other applications.

Send for Cat. D2-1042 fully describing and illustrating this new Economy SCV pump.



ECONOMY PUMPS, INC.

1020 Weller Ave.

HAMILTON • • • OHIO

What big ears you have!

Long before the first faint hum of a plane can be heard, these giant ears have detected it and the anti-aircraft guns swing into menacing position.

Inch by inch, foot by foot, they turn, following every movement of the approaching craft; and as they turn, the synchronized guns turn, too. Woe to an enemy who chances within their range!

The delicate mechanism that points these guns owes its accuracy in no small measure to the reducers that control the micromatic movement through the arc and bring the guns to bear exactly on their objective.

And Foote Bros. speed reducers are on this job at listening posts with the Army and the Navy throughout our possessions and on our far-flung fronts doing their part in protecting our forces against air-borne aggression.

The lessons learned in the school of war are already assuring our Armed Forces of better speed reducers—sturdier and more compact speed reducers. These same lessons applied to post-war manufacturing promise a new conception of the transmission of power to American manufacturers after the war.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard
CHICAGO

FOOTE BROS.

Better Power Transmission Through Better Gears

COMPLETE IMMERSION

Cannot Soak

White wool in water saturates and sinks. B-H bobs water-free to the surface.

BALDWIN-HILL
BLACK ROCK-WOOL INSULATIONS

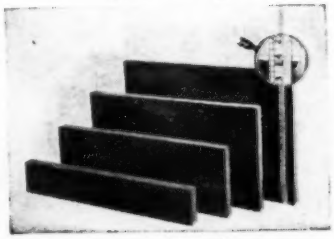
MOISTURE does not disintegrate this utterly different form of rock wool. It does not make it settle. It can't ruin its insulating value. By actual test, B-H black rock-wool absorbs less than 1% of its weight in moisture after being immersed completely.

That is one reason for specifying B-H black rock-wool. Another—equally important—is its stability under heat and vibration. 1400° of flame, which cut their way right through ordinary white rock-wools, leave B-H unharmed. Remember these facts and investigate B-H black rock-wools, felts, blocks and cements.

B-H

FREE TO POWER-PLANT MEN

A generous sample square of Baldwin-Hill Mono-Block, the one block for all temperatures up to 1600°, together with a sample of B-H Bond-Tite, the easy adhesive which makes wiring unnecessary. Test for yourself the heat-resistance, the extraordinarily low conductivity, the quick adhesion, and ease of cutting of this universal insulation. Just write us on your letterhead.



BALDWIN-HILL *Insulations*

575 KLAGG AVE. TRENTON, N. J.

NEW YORK CHICAGO KALAMAZOO

Turbine Type Pump

GASOLINE AND FUEL OIL pumps developed for pumping gasoline and fuel oil from tankers; pumping quenching oil and other liquids, etc. In these applications the advantages of these pumps include elimination of priming difficulties, low installation cost, minimum floor space requirements, high efficiency, low operating cost, and freedom from lubrication difficulties. Capacities of turbine-type gasoline and fuel oil pumps range up to 1000 gpm against head pressures generally encountered in gasoline fueling systems. Higher capacity available at slightly reduced pressure in case of increased demand. For even greater flexibility, the impellers are easily adjustable for changes in capacity or to compensate for eventual wear after long service. Pumps are self-venting and cannot become vapor locked. These pumps are regularly furnished with totally enclosed, explosion-proof vertical motor where highly volatile liquids are to be handled. Right angle drive can be furnished with flexible shaft for connecting to driving unit where it is desirable to operate the pump with a horizontal motor, or engine in a separate room. Combination drives are also available to provide emergency operation in case of power failure. *Deming Co, Salem, Ohio.*

Welding Control

GREATLY SIMPLIFIED CONSTRUCTION is one of the several important features characterizing electronic capacitor discharge resistance welding control for aluminum welding. This construction not only eliminates much vital material but facilitates thorough inspection and servicing. Employing energy-storage principle, control effectively performs all the functions for which a control of this type is designed. Aluminum has low resistance and high heat conductivity. This control provides high currents and short welding time required for the satisfactory resistance welding of this metal. Control consists of a charging circuit, a discharge circuit, control station, Pyranol capacitors and a sequence control. *General Electric Co, Schenectady, N. Y.*

Micro Scale

MICRO-SCALE consists of a standard machinist's scale divided into 64ths of an inch and a magnifying attachment. The magnifier is a patented plastic lens mounted on a slide block which is used

They're shooting the works

Garlock

and they're relying on us!

The men in our armed forces are giving everything they've got to this fight for freedom—and they're depending on us back home to supply the tools of war.

One way to help maintain war production at full capacity is to use *quality* packings, gaskets and oil seals—and use the proper material for each requirement. A GARLOCK representative will be glad to advise you. Call him in!

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

FLEXPEDITE

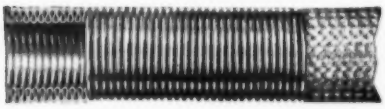
Your Conversion—Assembly—Production

with

REX-WELD

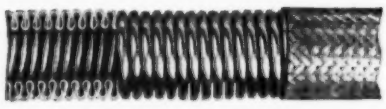
Flexible Metal Hose

Rex-Weld Hose—Annular Corrugations



RW-80 Unbraided ——— RW-81 Braided

Rex-Weld Hose—Helical Corrugations



RW-90 Unbraided ——— RW-91 Braided

—General Data—

	STEEL	BRONZE
Sizes	To 4" I.D.	To 4" I.D.
Pressures	To 14,500 p.s.i.	To 14,500 p.s.i.
Temperatures	To 1000° F	To 450° F.
Lengths	To 50′	To 50′

—Use Chart—

	*STEEL	BRONZE
Saturated Steam		✓
Superheated Steam	✓	
Sulphur Bearing Oil	✓	
Oxygen		✓
Ammonia	✓	
Carbon Dioxide	✓	
Sulphur Bearing Grease	✓	
Critical Vibration		✓
Non-Sparking		✓

*Protective Coatings Can Be Applied for Corrosion Protection (To Conserve Critical Copper Bearing Alloys).

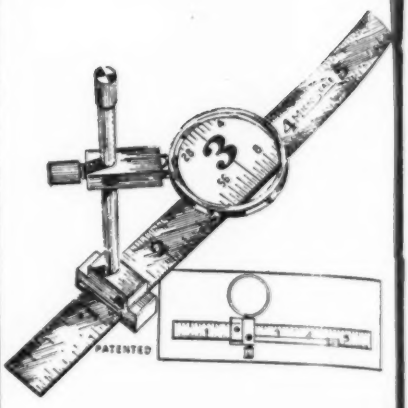
Couplings: REX-TITE Mechanical (Re-attachable) Couplings; Solder Couplings; Brazed and Welded Couplings and Flange Assemblies for Rex-Weld Flexible Metal Hose.

Ask for Engineering Recommendations

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Ill.



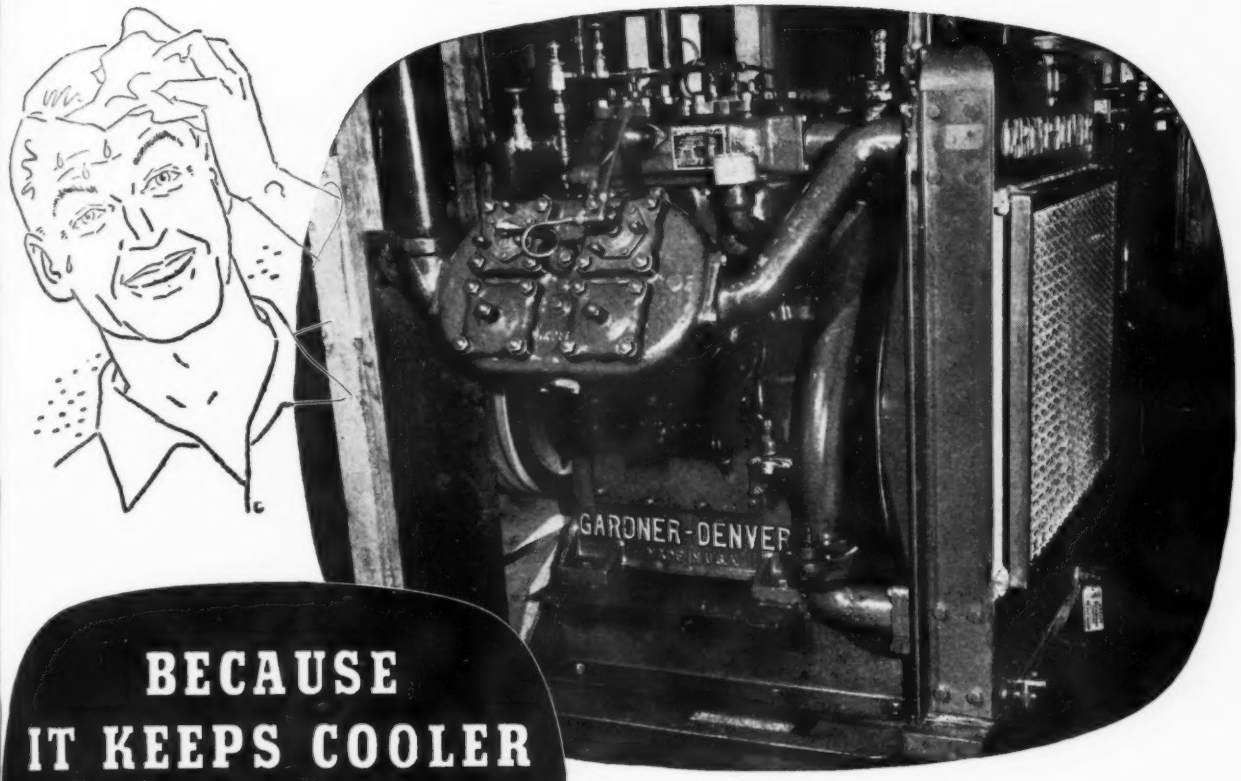
to check the length of parts, depth of holes, center distances in layouts, finishes of metal, etc. *Leonard Engineering Co, Silver Spring, Md.*

Lubricating Oil

CORPORATION ANNOUNCES new lubricating oils called Gulf Dieselube H.D. (Heavy duty) made to meet U. S. Army specifications for internal combustion engines for ground equipment. They have also been approved by the leading manufacturers of diesel engines for tractors and trucks. These are oils of the highest quality for use in portable marine and industrial installations as well as other diesel engines for which manufacturers and operators demand detergent type oils non-corrosive to alloy bearings and which eliminate as far as possible ring sticking and engine deposits. These oils contain blended ingredients which reinforce their resistance to the heat encountered in motors and transmissions, provide increased film strength and offer increased production to alloy bearings against corrosion, according to the manufacturer. *Gulf Oil Corp, Pittsburgh, Pa.*

Fluorescent Reflector

WOOD REFLECTOR saves large amounts of steel vital to war effort. It is made of processed wood pulp formed into dense, smooth hard board by heat and high pressure. Reflector board is sprayed with a new synthetic enamel that dries under heat by polymerization. Molecules of enamel form into long chains producing a surface as hard and durable as steel. Unlike porcelain-coated steel reflector, new surface is not chipped when the unit is dropped or struck with a hammer. New reflector saves sheet steel and is superior in many ways to porcelain-covered steel. It is about one-third lighter in weight; its reflection factor is between 85 and



BECAUSE IT KEEPS COOLER ★ *You can, too!*

WHEN jobs are "hot"—when production must be rushed—operators who have Gardner-Denver "WB" Vertical, Two-Stage Air Compressors can keep cooler. These fully water-cooled compressors assure a full day's work, every day of the month.

Get the full details from Gardner-Denver Company, Quincy, Illinois.

Here's what water-cooled compressor performance means in the plant:

1. Lubricating oil economy and substantial savings for you.
2. Cooler discharge temperatures that are easier on your valuable air hose and air tools.
3. Sustained performance that means full air output every shift.
4. No pampering required for full air output at any altitude or temperature. The compressor is equally at home in frigid air or in a hot engine room.

OTHER "WB" ADVANTAGES

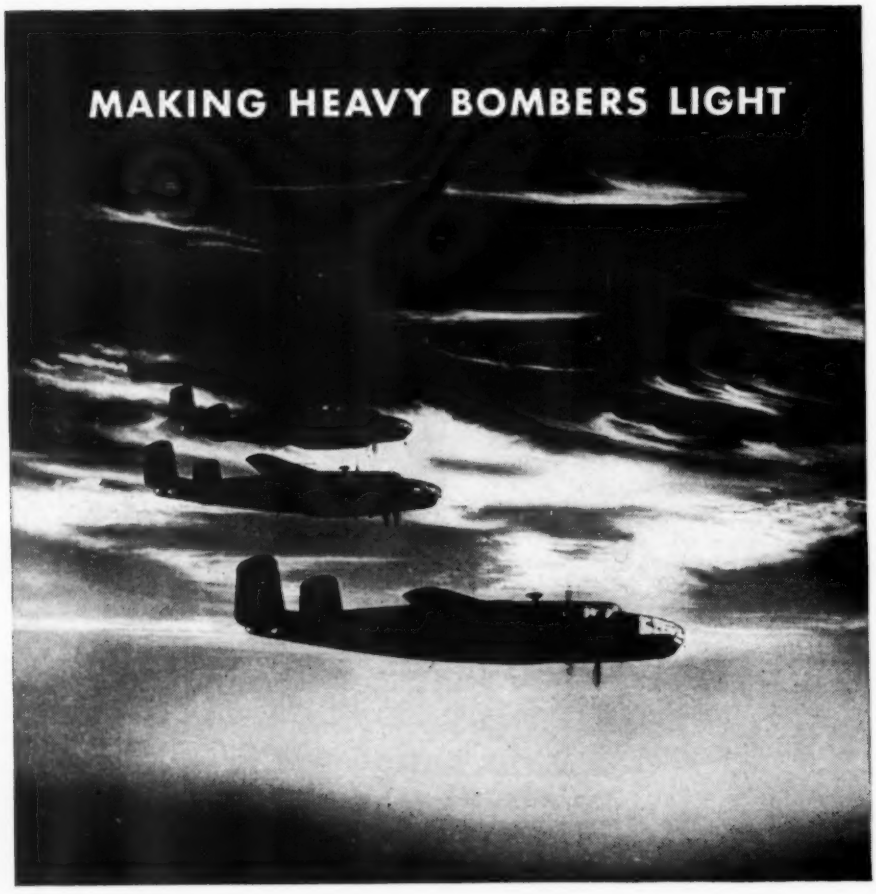
★ A rugged unit especially designed to conserve space.

★ Operates at efficiencies comparable to those of much larger compressors.

★ Castings of GarDurloy give extra strength and hardness where needed.

★ Capacities range from 142 to 445 cubic feet displacement per minute.

GARDNER-DENVER *Since 1859*



Buell Dust Recovery Systems play an important part

The lighter the bomber itself, the bigger its bomb load. So America's air might is muscled with modern metals—aluminum, magnesium, beryllium, molybdenum and others—that are miracles of both strength and lightness. In the bombers above, for instance, motor weight per horse power is barely over a pound—down from 12.7 lbs. per h.p. at Kitty Hawk.

Buell Dust Recovery Systems play an important part in the process of transmuting ore into these vital metals. Installed in conjunction with pulverizers, kilns, roasters and sintering furnaces, Buell cyclones recover for re-use virtually 100% of the critical material that would otherwise escape in the flue gases —a saving that mounts up to thousands of tons annually.

The high efficiency of Buell Dust Recovery Systems is due to the van Tongeren cyclone—an ingenious design feature found only in Buell equipment. Long life, low operating cost, negligible maintenance and unlimited capacity are other important advantages that have made Buell Dust Recovery Systems first choice with so many great industrial concerns.

BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York
Sales Representatives in Principal Cities

buell
DUST RECOVERY SYSTEMS

Factual 28 pg. book. Write for Bulletin G-842.

Memo to

POWER PLANT ENGINEERS

Buell Dust Recovery Systems, with special designs for all types of solid-fuel burning boilers, offer outstanding advantages in

High Efficiency with Low Power Consumption

Buell equipment is used by leading industrial and utility power plants, such as: Detroit Edison Co., Indianapolis Power & Light Co., E. I. du Pont de Nemours & Co., Curtiss-Wright Corp., Wright Aeronautical Corp., and many others.

BUY WAR BONDS AND MAKE THE AXIS BITE THE DUST

90% compared to 80% for white porcelain; and the over-all light efficiency is 2% higher and the resistance to corrosion is better than enamel. New reflector is fully interchangeable with porcelain-enameled reflectors. *Westinghouse Elect & Mfg Co, East Pittsburgh, Pa.*

Gear and Wheel Pullers

STEELGRIP PULLER is equipped with forged heat-treated rigid arms. Cap screws, straps, etc, are also heat-treated steel. The hardened forcing screw is 6 in. long with fine threads and is pointed on the end. The unit will take gears, wheels, etc, up to 6 in. in diameter and has a 3¼-in. reach from end of shaft. *Armstrong-Bray Co, 5364-78 Northwest Highway, Chicago, Ill.*

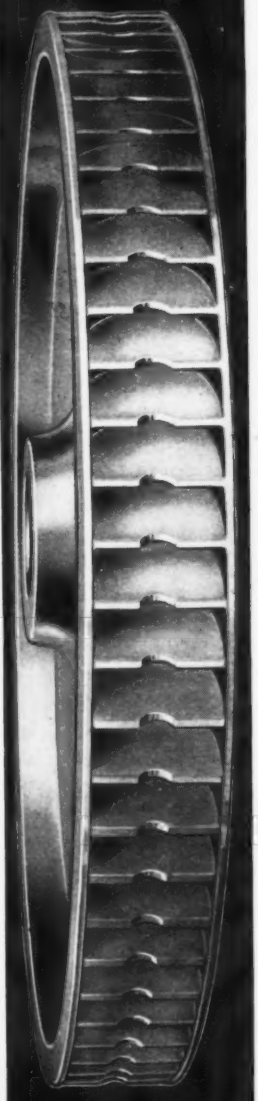
Diesel Fuel Concentrate

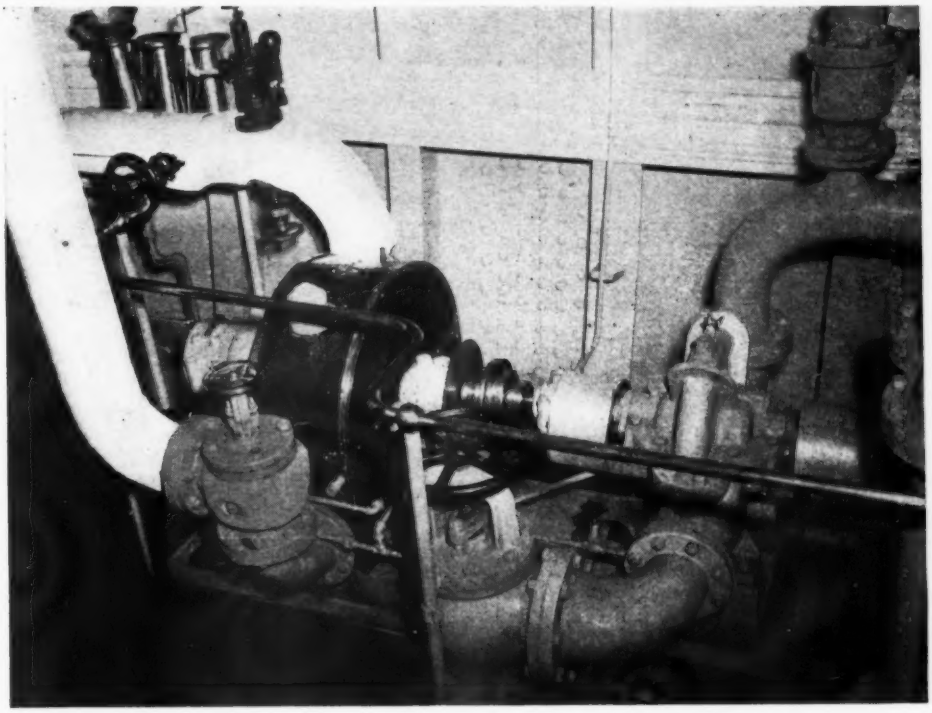
THIS CONCENTRATE used in the proportion of 5 gal per 1000 gal of fuel oil is a blend of high-quality oils with stable synthetic organic compounds of high boiling point. Said to aid materially in solving diesel engine problems of ring and valve sticking, sludge or gum deposits, carbon injector contamination and piston or cylinder wear. High boiling point of the solvents in this product enables it to function in the ring belt area and in valve chambers where ordinary lubricating oils are readily dissipated. Concentrate said to provide better fuel combustion and cylinder lubrication for diesels. *E F Houghton & Co, 303 Lehigh Ave, Philadelphia, Pa.*

Worm Gears

SMALL WORM GEARS produced for ratios of 35⅝:1 up to 60:1, in 3- and 3½-in. center distances. They are distinguished by having casings cast in one piece, the casing with side plates totally enclosing the working parts and serving

TERRY





Above—50 H. P. Terry Solid Wheel Turbine driving Fire and Sanitary Pump on recently completed merchant ship. Steam condition: 450 lbs. 750° TT - 10 lbs.

FOR AUXILIARY DRIVE— THE TERRY SOLID WHEEL TURBINE OFFERS MANY ADVANTAGES

FROM THE SMALLEST TO THE LARGEST, THESE RELIABLE TURBINES HAVE—

- ★ Indestructible one piece wheel.
- ★ Large radial and axial clearances.
- ★ Double rim protected blading.
- ★ Individual nozzle control.
- ★ Dependable and durable governor.
- ★ Heavy dust-proof bearing and governor housing.
- ★ Independent overspeed trip with separate valve.
- ★ Sturdy casing design.
- ★ Strong and easily inspected steam strainer.
- ★ Truly accessible construction, which makes inspection of the interior parts a simple matter.

FOR FULL DETAILS ASK FOR BULLETIN S-116

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Don't Scrap It!

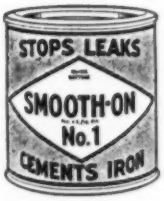
Repair It With SMOOTH-ON

When a piece of a flange becomes broken off, a thoroughly practical and permanent repair can be made with SMOOTH-ON No. 1 without the use of heat or dismantling the apparatus.

Paint a thin coat of SMOOTH-ON on both surfaces of the break, and shrink an iron band around the circumference of the flange. If the break is across a bolt hole, an iron washer may provide sufficient reinforcement for the repair.

SMOOTH-ON No. 1 is equally effective for sealing cracks in pump casings, heat exchanger shells, and other pressure vessel castings. Today, when new equipment is hard to get, and production delays cannot be tolerated, SMOOTH-ON is an indispensable necessity in every plant.

Get Smooth - On No. 1 in 7-oz., 1-lb., 5-lb. or 25-lb. containers from your dealer, or if necessary from us. For your protection, insist on SMOOTH - ON, used by engineers and repair men since 1895.



FREE
40-PAGE HANDBOOK

Simple, concise instructions for hundreds of material-saving repairs to plant equipment and pipe lines are given in this 40-page practical repair manual. A war-time necessity in every plant. Your copy sent FREE, if you fill in and return the coupon.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City, N. J.
Please send SMOOTH-ON HANDBOOK.

Name .....

Address .....

3-43

Do it with SMOOTH-ON

as an oil reservoir from which the bearings and gear teeth are lubricated. Interior is accessible by removing one side plate, although the only attention required is checking the oil level at long intervals, for which purpose a gage cock is provided. Worm shaft is carried on ball bearings and the worm and worm shaft are of carburized nickel steel heat treated after machining. Units supplied for either top or bottom drive with shaft extension to either right or left or in both directions. Lower ratios can be used as speed-increasing gears up to a maximum speed of 2000 rpm. *DeLaval Steam Turbine Co, Trenton, N. J.*

Rustproof Paint

SATISFACTORY ALTERNATIVES for aluminum paint, two products said to give maximum results. These are "alternates to aluminum paint," No. 18328 silver gray and No. 906 fume-proof silver gray. The first is manufactured strictly for outdoor and some indoor uses on metal, concrete, brick and wood. It gives a high-gloss finish and dries in from six to eight hours. This is for use in maintenance and new construction work in light, industrial, residential and agricultural districts where only minor fume conditions exist on sash, buildings, tanks, fences, bridges, structural steel, etc. No. 906 paint is used in heavy industrial districts and where smoke, brine, dampness or fume conditions are severe. The paint is said to withstand 450 F and all weather conditions. *Rust-Oleum Paint Corp, Evanston, Ill.*

Weld Cleaning Tool

DUAL-TOOL COMBINES a wire bristle brush and a slap-removing bit in one unit and features a specially-developed brush holder which permits removal of brush for reversing or replacement by inserting screw driver or other sharp object at rear end of holder. Every part of the tool is replaceable. The tool is used by welders in shipyards, aircraft and tank plants, boiler and

gain hours

Use Laminum shims to reduce parts machining for easier work tolerances in factory adjustment! More machine hours released for production.

Laminum shims (.003 or .002 inch precision laminations bonded into a solid unit) are cut to your specifications.

Stock shim materials obtainable from mill supply distributors. (Write us for sample and illustrated shim application chart.)

Laminated Shim Company
Incorporated
61 Union Street **Glenbrook, Conn.**

it's

LAMINUM

THE SOLID SHIM THAT peels FOR ADJUSTMENT

How INCO Technical Service helps you conserve critical materials

No matter whether newspaper headlines feature priorities, "PRP", or the Controlled Materials Plan, the need for conservation never lessens. The war must be fought and won. That means critical materials by the carload.

Perhaps you know that every pound of alloy must give maximum service if our far-flung fighting forces are to be supplied and maintained. Nickel, particularly, is needed to give wartime steels greater strength, toughness and resistance to impact.

INCO's technical staff is organized to serve users of metals and alloys—to help manufacturers find and adapt alternative materials without sacrificing desirable and essential characteristics in the finished product.

So if you have a problem involving the use of alloys—Nickel or otherwise—please write or wire for data or counsel from our technical staff.

NICKEL

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

K & M STRAINERS are built by Specialists since 1879

We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration

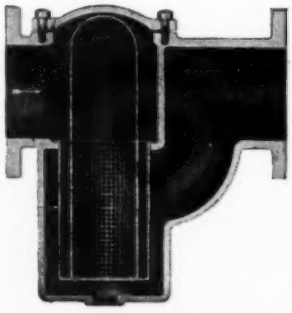
Back of K&M Strainers as well as all K&M steam specialties is an organization of engineers with an accumulated experience going back more than 63 years. An extensive line has been developed by Kieley & Mueller to cover power and process service requirements. Typical strainers in the K&M line are shown here.

"Y" STRAINERS

Designed for use on steam, water, air, gas, oil and other fluids K&M "Y" Strainers provide an efficient means of extracting foreign matter. Large strainer basket area assures minimum pressure loss. Baskets easily accessible for cleaning. Sizes: ½" to 6".

BASKET OR SUCTION STRAINERS

Designed and built for removing and preventing foreign matter from entering lines leading to vacuum pumps, feed pumps, water works lines, etc. May be used on water, oil, gas, steam or other fluids. Large free area strainer basket allows minimum pressure drop. Basket easily removed for cleaning. Sizes: ½" to 18".



KIELEY SINCE 1879 MUELLER

KIELEY & MUELLER

General Offices and Factory

2013-2033 — 43rd Street, North Bergen, N. J.

Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.

THE BURNING-END *THAT ENDS MANY COMMON STOKER TROUBLES*

—one of several important new features engineered by FREDERICK!

Frederick Stokers have *more active grate surface,* without dead plates . . . whether furnished with or without side dumping grates.

The specially designed tuyeres have air ports so arranged and proportioned as to insure complete air distribution and maximum combustion efficiency.

And, the wind-box is enclosed to simplify and make a neater installation, and to eliminate efficiency loss through leaky brickwork. *Two* cleanout doors are provided to allow thorough cleaning *both sides* of the grate area.

Yes, the new Frederick Stokers are DIFFERENT! A long list of original features distinguish them. Many common stoker problems are solved by them. And, if you're looking for maximum thrift, convenience and efficiency, we suggest you investigate.

All details upon request; no obligation.

FREDERICK STOKERS

THE FREDERICK IRON & STEEL COMPANY • FREDERICK, MD.

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS • ASH STORAGE BINS

sheet metal shops and for oil pipeline, factory maintenance, and general welding work. *Atlas Welding Accessories Co, 307 Boulevard Bldg, Detroit, Mich.*

Baking Varnish

SYNTHITE PX-5 black baking varnish is especially recommended for use on stationary and revolving units constructed with class B insulating materials. This varnish cures by heat induced chemical polymerization which solidifies the entire mass of varnish in the deepest winding voids or spaces. This curing characteristic eliminates surface sealing which usually causes uncured varnish to remain in the interiors of windings. The degree of curing can be controlled by varying baking temperatures between 245 and 275 F and controlling baking hour cycles. Varnish is recommended for use on flexible armature coils. *John C Dolph Co, Newark, N. J.*

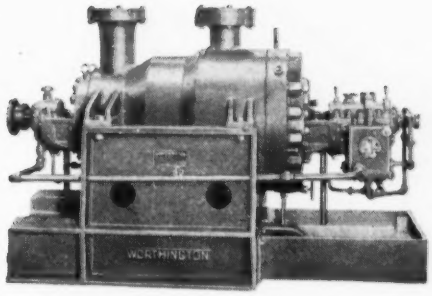
Hand Pump

BASIC DESIGN of new hand pump follows sliding-vane principle, characteristic of other Blackmer pumps. Base is fitted with an offset flange which permits mounting pump on the edge of any flat surface, such as the top of a tank, vat or other container, while providing ample clearance for free operation of the crank. Pump was developed primarily for use as a bilge pump on lifeboats and meets government specifications for this purpose. However, tests indicate that there are a number of other applications, both marine and industrial, in which this new unit represents an improvement over present pumps. It will become an addition to company line. *Blackmer Pump Co, Grand Rapids, Mich.*

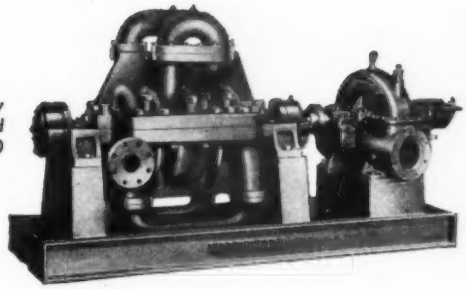
Bonding Process

FUSE-BOND PROCESS and equipment for metal spray application, whereby the machine components and similar metal parts now may be prepared for metallizing electrically. Main advantage of process is that it affords an adequate bond on hardest surfaces, heretofore impossible or impractical to repair by blasting or rough threading. It also simplifies preparation of narrow edges, flat areas, and cylindrical parts having keyways and other interruptions in their surfaces. Application of the process is with the Metco Fuse-Bond Unit. Operating on any 110- or 220-volt single phase power line, this equipment fuses a rough deposit of electrode metal into the surface to be metallized. Electrodes

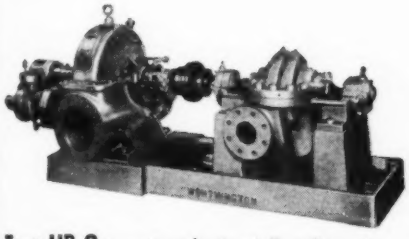
WORTHINGTON



Type WC *Multistage solid forged steel barrel boiler feed pump—capacities up to 3000 GPM—pressures up to 3000 p.s.i.*



Type UX *Multistage large horizontally split casing, axially and radially balanced boiler feed pump—capacities up to 1500 GPM—pressures up to 1250 p.s.i.*



Type UB-2 *two-stage horizontally split casing boiler feed pump—capacities up to 1500 GPM—pressures up to 450 p.s.i.*

COMPLETE COVERAGE in Centrifugal BOILER FEED PUMPS

Worthington offers the power plant designer the most complete line of modern service-proven centrifugal boiler feed pumps.

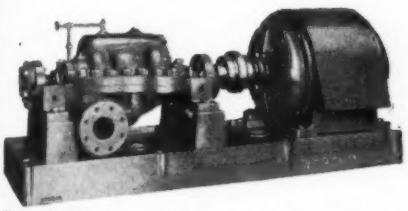
This line includes horizontally split casing and solid forged steel barrel multistage pumps.

Worthington's position is unsurpassed on its preparedness to furnish *the correct boiler feed pump built of the correct materials* for any operating condition.

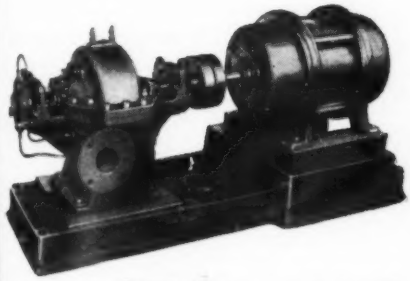
The types shown are but representative of the extensive Worthington line of centrifugal boiler feed pumps—many others are available.

Electric Motor or Steam Turbine Drive

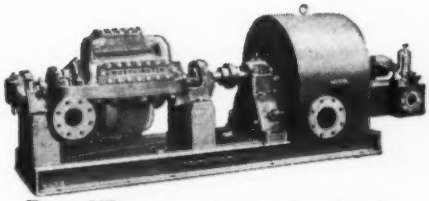
Both the Navy E and Army-Navy E Awards have been presented to Worthington for speed and excellence in production.



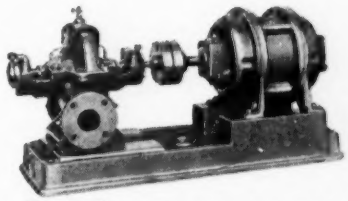
Type UQ *four-stage horizontally split casing boiler feed pump—capacities up to 1500 GPM—pressures up to 650 p.s.i.*



Type U *two-stage horizontally split casing boiler feed pump—capacities up to 300 GPM—pressures up to 250 p.s.i.*



Type UR *six-stage horizontally split casing boiler feed pump—capacities up to 750 GPM—pressures up to 800 p.s.i.*

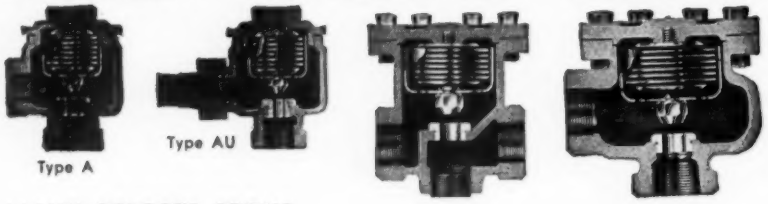


Type R *single-stage horizontally split casing boiler feed pump—capacities up to 400 GPM—pressures up to 200 p.s.i.*

CP3-6

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY

DON'T OVERLOOK THIS POSSIBILITY FOR INCREASED PRODUCTION



Type A Type AU Type B Type C

MANY REPORTS PROVE THAT THESE NICHOLSON INDUSTRIAL TRAPS BOOST EFFICIENCY OF HEATED UNITS AS MUCH AS 30% THRU BETTER CIRCULATION OF STEAM

Two to six times greater discharge capacity. Quick automatic action. No air-binding . . . no dribbling . . . no freeze-ups . . . no water logging . . . no adjustment. Frequent intermittent discharge induces rapid heat transfer in water heaters, pipe coils, kettles, driers, unit heaters, etc. Four types; sizes ¼" to 2"; pressures to 300 lbs.

Bulletin No. 242—W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA.

NICHOLSON *Traps*

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES

PRECISION-built? Sure they are! Correctly designed? Yes, sir! Constructed from finest, carefully selected materials? Every part! But, this is what really is important to you: Every Lonergan gauge indicates pressures accurately on a clear, easy-reading dial...and retains its high initial accuracy even under violent pulsations! That's why Lonergan gauges are standard in many plants.

J. E. LONERGAN CO.
Race & 2nd Sts., Phila., Pa.

Lonergan

SIGN OF PROGRESSIVE ENGINEERING!

SINCE 1872

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES •

are applied to the work with a special holder which uses up to six electrodes at a time depending on the size and nature of the part to be prepared. Small parts may be prepared with this equipment as easily as large shafts. There is no excessive heating of the base metal or disturbing of its physical characteristics. *Metallizing Engineering Co, Inc, Long Island City, N. Y.*

Spot Welding Control

ELECTRONIC HALF-CYCLE synchronous control for precise operation of resistance-welding equipment has been announced. Mounted in a protecting cabinet control is furnished in two types: the CR7503-A136, which also includes a welding transformer and is designed for bench mounting and the CR7503-A133, which is without a transformer and is designed for wall mounting. Both can be used either with tongs or with a suitable bench welder. The control features a new tube; a new circuit which makes higher-speed welding possible; a simplified initiating circuit which improves performance and reduces maintenance. New design also incorporates heat control by the phase-shift method. Heat adjustment is made by a dial mounted on the front of the cabinet. Control also makes possible the welding of low-resistance joints unaffected by temperatures considerably in excess of 125 C, the point at which certain types of soldered joints weaken and often collapse. *General Electric Company, Schenectady, N. Y.*

Reset Timer

RS4 AND RS5 synchronous-motor-driven timers of reset type now available for time ranges up to five hours and longer if desired. Timers have wide application for accurately timing any electrical circuits such as machinery operations, chemical and food processes or heating processes. These timers repeat their time cycle upon manual operation of a built-in start button and indicate at a glance by means of a progress indicator, which moves towards the zero mark of the scale when in operation, the expired and unexpired time cycle as well as the setting time. These timers operate a single-pole double-throw switch, with a capacity of 10 amp at 115 volts or 5 amp at 220 volts ac non-inductive load and will control a ⅓-hp motor load, a heater load up to 1200 watts, a lamp load up to 250 watts or a relay load which does not exceed 15 amp inrush at 115 volts ac. *R W Cramer Co, Centerbrook, Conn.*

Drive up and unload an Airport!
ROEBLING "Blue Center"
helps them set the pace!
They start with a cow pasture and in a few hours have it ready for fighter planes taking off to battle . . . with the aid of "swiss cheese" steel strips woven into an all-weather emergency landing field! That's the kind of problem the Corps of Engineers drive on.
We know, because "Blue Center" goes long on so many of their assignments . . . from tractor cranes to mobile cableways, from river dredges to motorized winches. And whether it's lifting the face of Mother Earth for the Army or passing the ammunition for war plants, you'll find Roebling "Blue Center" Steel Wire Rope on the job wherever the going is tough.
Roebling is learning every day the ways to make "Blue Center" better than ever before. Roebling development engineering, facilities and experience give it the extra stamina to meet unusual as well as routine jobs . . . to give extra service wherever extra service is called for . . . toward Victory.
ROEBLING
"Blue Center"
STEEL WIRE ROPE
PREFORMED OR
NON-PREFORMED

It's your wartime duty to use wire ropes EFFICIENTLY!

Whatever your big job is, you've got a small but important job to see that wire rope is properly cared for on your *equipment*. To help you, Roebling has assembled a wealth of conservation data on convenient tags that operating men can fasten right on to reels and equipment. It's a simple, handy way to remind and instruct them about such vital precautions as:

1—PROPER INSTALLATION
2—CORRECT SPOOLING
3—PROPER USE OF CLIPS
4—REGULAR LUBRICATION
5—FREQUENT INSPECTION
6—CAREFUL OPERATION

Our nearest office will gladly furnish as many copies of this tag as you need. Ask for Tag "A".

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY *Branches and Warehouses in Principal Cities*

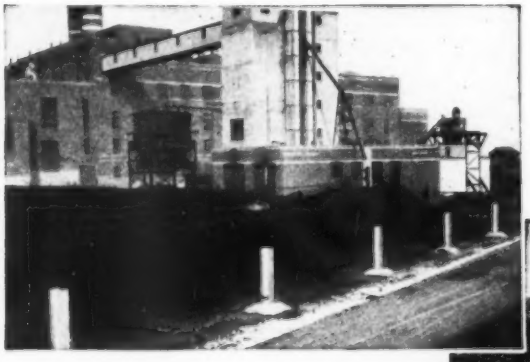
How To Get The Most Work Out Of Your VIKING PUMPS

In making suction and discharge pipe connections on a Viking Rotary Pump be sure that no strain is imposed on the pump casing by the pipe. Properly installed, the shaft of a Viking pump should turn easily by hand. If this is not possible you have either sprung the pump in making the pipe connections or with the foundation bolts.

For valuable help in installing, operating and maintaining your pumps, write today for your FREE copy of the Viking Service Manual. It's a handy, illustrated booklet filled with practical information. Get *extra* wear out of your pumps by giving them *extra* care. The Viking Service Manual tells you how.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA



STORE MORE COAL . . . *with Maximum Safety and Economy*

PROTECTION of vital fuel supplies on the home front is as important as guarding a ship convoy. More coal must be stockpiled this season than ever before.

Limited storage area at many plants requires fullest possible use of available space. Coal can be piled higher safely on the same ground space with a Sauerman Power Drag Scraper because it builds layer upon layer, avoiding segregation, forming a homogeneous pile that is safe from all danger of spontaneous firing.

Sauerman equipment conserves space, saves labor, eliminates the main combustion hazard.

Sauerman Advantages:

- Higher stockpiles
- Low cost handling
- One man operation
- Greater safety
- Adjustable to any space
- Upkeep is simple

SAUERMAN BROS, Inc.

562 S. Clinton St. | WRITE FOR CATALOG | Chicago, Illinois

Power Lines

(*Continued from page 124*)

Alaskan Highway, a data page on different types of packing and others. **More information** can be obtained from the Blackmer Pump Co, Grand Rapids, Mich. . . . At the annual stockholders' meeting and a subsequent directors' meeting, **S H Hobson** was elected a member of the board of directors and president to succeed **Mabon P Roper**, of the **George D Roper Corp. S L Large** and **H L Olson** of Rockford and **Bert Pratt** and **J Sanford Otis** were reelected to the board of directors. All other officers of the company were reelected.

o

Several organizational changes have been made at the Dunkirk plant of the **American Locomotive Co** recently. **Herman Franck,** who has been general superintendent was recently named **plant manager** to succeed **E F Boswell** who died last year; **Eugene Murphy** replaces Mr Franck as **general superintendent;** other appointments: **Robert Moore,** assistant superintendent in connection with the pipe, exchanger and gun work; **Arthur Ganslow,** assistant superintendent in charge of exchanger work; **Andrew Groesch,** foreman of the plate shop; and **Joseph Langenstein,** foreman of the machine shop. . . .

o

The Everlasting Valve Co, Jersey City, N. J. reports with regret the death of the vice president and one of the founders, **William F Madill** on Jan 9, 1943 . . . **John T Hoyt** has been appointed comptroller and **R C Gray** works manager of the **Robins Conveying Belt Co,** Passaic, N. J. . . . On the 23rd anniversary of the founding of **Detroit Rex Products Co,** Ellsworth W Allison was elected assistant secretary of the company.

o

Babcock & Wilcox Tube Co, Beaver Falls, Pa. announces that **William J Thomas** and **Leon E Jeanneret** have been appointed assistant general sales manager of the B & W Tube Co at Welded Tube Division, respectively. **Edward A Livingstone,** general sales manager and manager of sales of the Beaver Falls will also be general sales manager of the B & W Co, Welded Tube Division of Alliance. . . . To help earth-movers handle their equipment and

HOW... are Ljungstrom Air Preheaters helping to increase the efficiency of synthetic rubber production?

✓ In generating the huge quantities of steam required for power and process use, Ljungstrom Air Preheaters recover waste heat from the flue gases and transfer it to the combustion air being fed to the boilers. This increases the efficiency of combustion, raises the capacity of the steam generating units, saves fuel and critical materials.

✓ In furnishing process steam at 1400 deg. F. or higher, using separately fired superheaters, Ljungstrom Air Preheaters also serve to assure maximum heat recovery and to improve combustion.

✓ For cracking stills and other petroleum processes furnishing synthetic rubber constituents, high-temperature Air Preheaters recover heat from the furnace gases and permit a type of furnace design which cuts steel required for convection tube banks.

WHY..... are more Ljungstrom Air Preheaters being selected for synthetic rubber plants than all others combined?

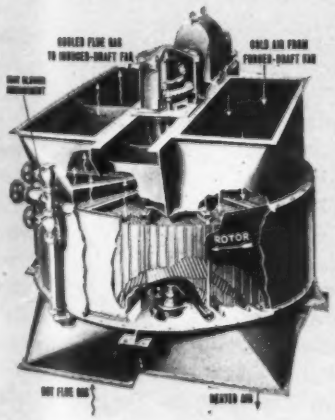
✓ The Ljungstrom Air Preheater transfers heat from gas to air using only *one-half* to *one-third* the weight of steel required by other designs.

✓ In addition to steel saved in the unit itself, there are additional savings in the supporting structure, due to the Ljungstrom's lighter weight and smaller size.

✓ Continuity of operation, particularly in high temperature applications where gases at 1400 deg. F. and more may enter the unit, is a well proved advantage of the Ljungstrom.

✓ Hundreds of these units in service at central steam stations, oil refineries and chemical process plants, give a groundwork of operating experience which means a *faster*, more assured solution of your gas-to-air heat-transfer problems.

HOW THE LJUNGSTROM AIR PREHEATER OPERATES



In the Ljungstrom, the heating surface is incorporated in a compact, slowly rotating cylindrical unit. It acts to "soak up" the heat in the gas chamber and then, upon rotation, to liberate it to the entering air. By means of this *continuous regenerative counterflow* principle, the maximum transfer of heat is obtained with minimum weight and size. One inch in height of Lungstrom heating surface is equivalent to one foot in height of tubular or plate surface.

THE SCORE

Recent wartime orders for Ljungstrom Air Preheaters include:

For Synthetic Rubber Production	21 units*
For Petroleum Refining	23 units**
For Ordnance Manufacture	14 units
For Other Chemical Processing Plants	4 units
For Metal Refining	4 units
For Steam Power Generation in War Prodution Areas	10 units

*including 6 units for use on separately fired superheaters

**including high-temperature units for cracking still furnaces

THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

Keep These Vital Tools in Perfect Condition

Suppose an emergency required you to open one of your boilers, condensers or other tubular units today. Would you be able to take advantage of this condition by descaling tubes while the unit is down?

How long is it since you looked over your tube cleaners? Why not do it now, while you think of it? They may need adjustment, repair or parts replacement. You'll have to use your tube cleaners sooner or later, perhaps sooner than you expect. So why risk tieing up the unit on account of tube cleaners? Get them ready for immediate action now.

The ROTO Company
145 Sussex Avenue
NEWARK, N. J.

ROTO TUBE CLEANERS

Write for Working Sample
Send for 36 page catalog.

Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

PATENTED "EUREKA" TRADE MARK

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

make it last longer, **R G LeTourneau, Inc,** of Peoria, Ill has prepared a quick reference **lubrication chart** on the complete LeTourneau line. Poster is 16 x 20 in. This service bulletin is available free to all who care for and operate LeTourneau equipment. Contact your local dealer or write direct to R G LeTourneau, Inc, Peoria, Ill. Ask for Bulletin G-1052.

Paul Wooton, Washington correspondent of the McGraw-Hill publications, was elected president of the **White House Correspondents' Association** on Jan 18. Mr. Wooton has served the organization for several years as its secretary and treasurer. In that position he has handled the business side of the Association's affairs.

Power formerly wasted in testing aircraft engines is now being saved for war production by connecting the motors to electric generators, says **R H Wright,** Westinghouse engineer before the recent Birmingham meeting of the Association of Iron and Steel Engineers. **At some large aviation engine** plants such generators in the testing department supply a large part of the electricity needed to run the entire plant. Before this system was developed, **heavy wooden propellers** were put on new engines during test and shakedown runs. **As wartime production** of engines increased this waste of power from high-test aviation gasoline became too sizeable to ignore so generators were designed to capture the output of the motors on test. Some of the electricity generated is routed to electric motors which turn over new plane engines at the end of the production line. . . . Because a limitation order setting **standards for safety valves** is now being worked out (Feb 2, 1943), all reference to such valves has been deleted from **Limitation Order L-134** which curtails

The age-old Chinese custom of paying the physician to *keep well* reflects the wisdom of this ancient race. Prevention is far better than cure.

And likewise, in industry, boilers that are protected from breakdown by intelligent and continuous feedwater conditioning will continue to operate at maximum steam output with a minimum of time out for overhaul

W. H. & L. D. Betz is an organization of engineers and chemists, trained and skilled in the science of boiler feedwater conditioning for the prevention of scale, corrosion, carryover and embrittlement. Our service is complete for all industries, with prescribed treatment specifically recommended for individual requirements.

We have laboratories and engineers located throughout the United States and Canada.

W. H. & L. D. BETZ

FRANKFORD • PHILADELPHIA • PENNA.

CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

"Decreased our furnace upkeep costs," says a well-known steel mill about . . .

ADAMANT
FIRE BRICK CEMENT

Users know the use of Adamant brings real savings because its exceptionally high bonding strength assures longer life of furnace linings. To prove this, impartial laboratory tests were made that showed that Adamant has a bonding strength of 800 lbs. per sq.in. at room temperature, 1270 lbs. per sq.in. at 2600° F. *"Its strength increases as the temperature rises"*.

ADAMANT has a P.C.E. of over 3000° F.

For more complete information, write us.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co. Ltd., 171 Eastern Avenue, Toronto

Space Saving Possibilities

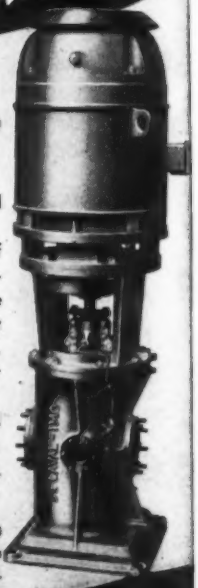
The
De Laval-IMO OIL PUMP

is exceedingly simple and compact.

Because of absence of valves, gears and reciprocating parts it can be directly coupled to run at motor or turbine speeds. There is no vibration or pulsation.

It handles any oil against any pressure.

Ask for Catalog 1-95.



Lube oil service pump; 300 g.p.m. of 130 SSU oil from 10 in. Hg. suction to 50 lbs. per sq. in. at 1150 r.p.m.

IMO MOVE OIL

IMO PUMP DIVISION
of the
De Laval Steam Turbine Company
Trenton, New Jersey

the use of various metals in the broader category of controlled valves and regulators.

o

More than 10,000,000 placements were made by the United States Employment Service in 1942, according to War Manpower Chairman Paul V McNutt. The placements were 37% above the 1941 total. Most of the increase, the chairman explained, was in manufacturing and agriculture. **Manufacturing placements** increased about 47% and agricultural about 64%. . . . Arrangements have been concluded whereby **combustion engineers** in the employ of bituminous coal producers are available for call to assist the Corps of Engineers, U.S. Army on problems pertaining to the use of bituminous coal at army camps, posts, hospitals and other coal-fired installations of the War Department. Cooperation of the combustion engineers in the employ of member companies was offered at a meeting of **Bituminous Coal Research, Inc,** held at **Battelle Memorial Institute,** Columbus, Ohio on Dec 11, 1942.

o

Timothy J Lynch, over 25 years New England district manager for the **Allis-Chalmers Mfg Co** in Boston, died in that city on Feb 2, 1943. He was a native of Greenland, N. H. and before going to Massachusetts he spent about 15 years in the company's plants at Milwaukee and Toronto. He retired about three years ago.

o

Word has reached New York of the death at Mayo Clinic in Rochester, Minn. on Feb 1 of **Albert H Reiber,** vice president in charge of development and research for the **Teletype Corp** of Chicago. Mr Reiber was a graduate of **Stevens Institute of Technology** with a degree in mechanical engineering in 1916. . . . **The American Pulverizer Co** of St Louis, Mo. announces the appointment of **Howard L Hill,** 101 Park Ave, New York as their eastern representative.

o

The War Manpower Commission and Selective Service have reaffirmed in a revised Occupational Bulletin No 9 the essential nature of most of the **electric utility occupations** which were held to be in support of the war by the latter agency last spring. Although the list of 86 occupations which Selective Service originally considered **cause for occu-**

Your Blueprint for
MORE POWER
starts with
OAKITE CLEANING

. . . Safe Way to De-Scale Your Diesel Cooling Systems

Are your Diesel engines producing the maximum power of which they are capable on the fuel consumed? Are they running efficiently, economically . . . without overheating?

To meet this wartime "must," many power plant engineers and superintendents are taking advantage of the effective, safe Oakite method for keeping Diesel cooling systems free from scale and rust. No dismantling is required. By simply circulating a solution of Oakite Compound No. 32 through the cooling system or allowing to "soak" as directed, insulating deposits are SAFELY, QUICKLY, THOROUGHLY removed. Normal cooling efficiency is fully restored . . . power output kept at maximum.

24-PAGE BOOKLET FREE!

NEW, 24-page booklet gives details on this and other de-scaling jobs. Write for your FREE copy TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

Buy Bonds for Victory

OAKITE
Specialized cleaning
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

CLARAGE
ENGINEERS KNOW HOW

★ SHIPS ★

Well over 1,000 new ships — battle wagons, freighters and tanks already have ventilation, mechanical draft, or both furnished by Clarage equipment.

★ TANKS ★

In Libya, Tunisia, Russia, keeping tank motors cool is another job well done by small Clarage fans of special construction.

INDUSTRY

Clarage equipment helps factories making planes, guns, tanks, ammunition, chemicals, foods — helps them get maximum output from every worker, from every machine.

SPECIAL SERVICES

Back of our field engineers are design specialists, research and testing laboratories. We are geared to solve any air-handling problem, no matter how special. Try us!

INVEST IN VICTORY:
Buy More War Bonds!

A long list of products vital to Victory are built ***faster and better*** because Clarage air-handling and conditioning equipment is on the job!

Clarage manufactures fans, blowers, air washers, unit heaters, etc., in a wide range of types and sizes to meet every conceivable requirement . . . And we have application engineers in 43 principal cities to help you all the way from initial planning to Clarage equipment installed.

Don't let ***bad air conditions*** sabotage your war-time production. If you have a problem in our field, call the nearest Clarage engineer. He is experienced — KNOWS HOW! He has ideas. He will give you the kind of service your urgent needs demand.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

What do you mean...

SELF-LUBRICATING PACKING ?

Palmetto and other Greene Tweed packings contain qn extra reservoir of lubricant... not oil-can oil... but a special graphited lubricant which is hot-impregnated into every strand BEFORE braiding. This extra lubricant replaces that lost through wear and keeps Greene Tweed packings soft ... in service longer ... without danger of scored shafts.

Try a Greene Tweed Packing (see list below) ... and you will quickly learn its many benefits. Obtainable from your supply house or, if necessary, from us.

WRITE FOR LITERATURE

GREENE, TWEED & COMPANY

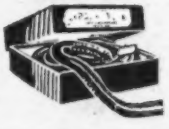
Bronx Blvd. at 238th St., New York, N. Y.

TWISTED

For valve stems; each strand a perfect piece of lubricated packing.

BRAIDED

For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



PALMETTO

for steam, hot water, air. PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *(blue asbestos) for acids.* KLERO *for foods.*

SELF-LUBRICATING

PACKINGS

pational deferment has been reduced to 51, broader WMC definitions for a number of categories make the amended list cover most of the original jobs. One notable deletion, being applied to all industries, is that of managers or asistants principally concerned with sales, promotional, legal, tax, clerical, insurance, rate structure and other non-technical and non-operating activities. **Technical and operating management jobs** remain in the latest issue of the regulation. WMC emphasized that the bulletin will not necessarily retain its present form for the duration but will be subject to reinspection and redefinition as the **manpower picture** changes.

o

Stumping the Experts: The opinions of the experts were divided: Some leading jewelers and jade connoisseurs thought the small black antiquated snuff bottle from China was of **black jade** and therefore rare and worth $1000; others believed the bottle was merely agate and worth about $25. The owner referred the bottle to Chicago's Field Museum and the museum in turn to the G-E X-Ray Corp. **X-ray diffraction patterns** quickly showed that the bottle was really of black jade, but even more amazing, the x-ray inspection explained why the jade was black instead of the usual white or green. Certain extra lines in the diffraction pattern checked with those produced by **manganous and titanium oxides.** Infiltrations of these oxides into the basically white jadite rock would account for the black color.

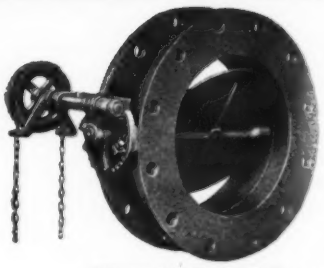
o

Charles H Trombley, 59, president of the **Rapp-Huckins Co, Inc,** Boston, Mass, Boston marine diesel engine house, died at Boston on Jan 25. . . . NEMA announces the release of new publications — **Electric Arc Welding Machine and Electrode Standards** (Publication No 42-81). Copies at 75 cents can be obtained through the NEMA Engineering Department, 155 E 44th St., New York, N. Y. . . . **James R Hewitt** has been appointed vice president of the **American Manganese Steel Division** of the **American Brake Shoe and Foundry Co.** This was effective Jan 1, 1943. . . . **William E Bibey,** 55, a development engineer for Boston Woven Hose & Rubber Co, Cambridge, Mass, died in that city on Jan 23, 1943.

o

At the twenty-sixth annual meeting of the **National Association of Fan Manufacturers** held in Buffalo, N Y on Jan

ROCKWELL BLAST GATES



Flanged Butterfly Type with **Chain Wheel Control**

Eliminate Air Leaks

Leaks can't occur at the blades, because of their tight closure . . . nor at the stuffing boxes, because of the deep, well-packed glands . . . nor at the pipe connections, because of the accurate machine work at threads or flanges.

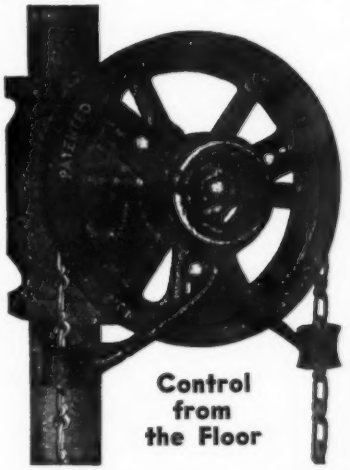
Rockwell Blast Gates assure perfect control of low-pressure air . . . after long service as well as when new. Write for Bulletin 4020 describing their many advantages in detail.

W. S. ROCKWELL COMPANY

Blast Gate Division

50 CHURCH STREET NEW YORK, N. Y.

Make Your Overhead Valves SAFE And Easy to Reach---

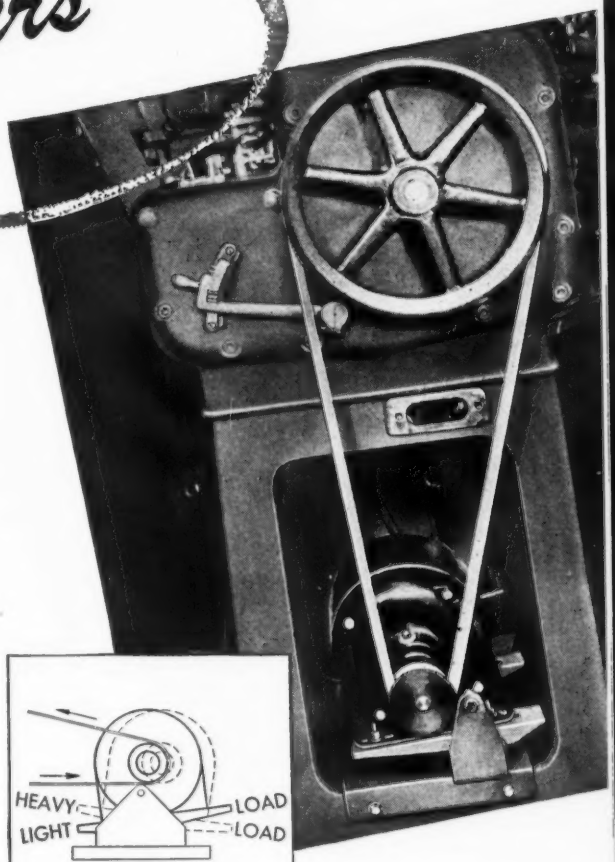


With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.

New Bedford, Mass.

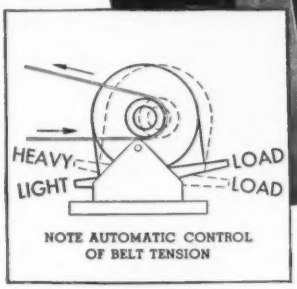
How one manufacturer eliminated "Belt-Eaters" and stepped up production 15%



In operating 50 candy cutting and wrapping machines, a well-known candy manufacturer faced several production and maintenance problems. Each of his machines had to be stopped ten times a day to be reloaded with wrapping paper. Since the starting load was 75% over normal load, belts and bearings wore out rapidly due to the high tension made necessary by the overload. Now he reports that by equipping all fifty machines with American Econ-o-matic Wedgbelt Drives, the trouble is eliminated. Belts take high starting load readily without slip. Belt take-ups have been entirely eliminated. Belt and bearing life increased. Production stepped up 15%. And maintenance costs are substantially cut.

Whether starting loads are light or heavy, improper belt tension results in many costly production and maintenance problems. When belts are too loose, you are losing R.P.M. and cutting down on the productive output of your machines. When tension is too tight, belts and bearings burn up, forcing shutdowns and interrupting production.

By changing over to an American Econ-o-matic Drive, you overcome these problems. You boost your machine output. You greatly increase belt and bearing life. The Econ-o-matic Drive is an American Short-Center Drive —either Flat-belt or V-belt—with an Econ-o-matic Motor Base that gives you *automatic* belt tension control. No more worry about belts too tight or too loose—no lost R.P.M.—no slippage—no unnecessary "time-outs" to make frequent manual adjustments—after you install American Econ-o-matic Drives.



NOTE AUTOMATIC CONTROL OF BELT TENSION

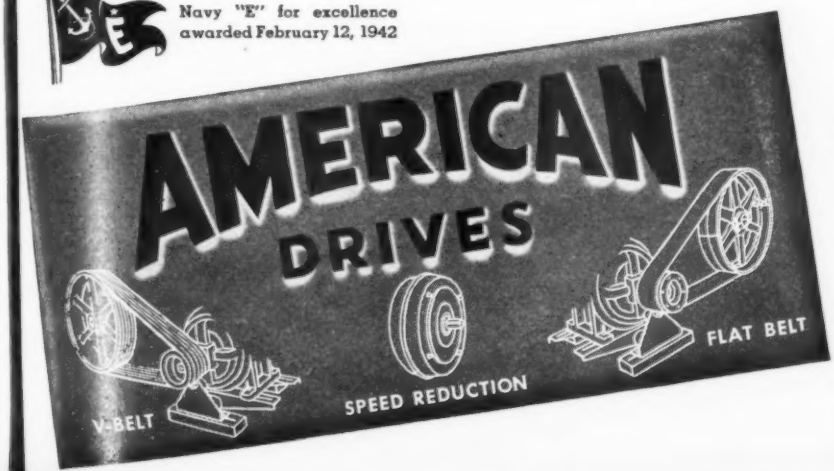
AMERICAN Econ-o-matic DRIVE

The load governs the belt tension. Here is the heart of the Econ-o-matic Drive . . . the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the load on the motor. When the load is heavy, motor base pulls and tightens the belt. When the load is light, motor base slackens and loosens the belt. No slide rails or idlers to adjust. It's *automatic!*

Check these advantages of the AMERICAN Econ-o-matic DRIVE (Short-center Flat- or V-Belt Type)

- ★ *Longer life for belts and bearings*
- ★ *No belt slip—no lost R.P.M.*
- ★ *Maintenance man-hours greatly reduced*
- ★ *Smooth, cushioned starting*
- ★ *Increased machine output*
- ★ *Substantial power savings*

Navy "E" for excellence awarded February 12, 1942

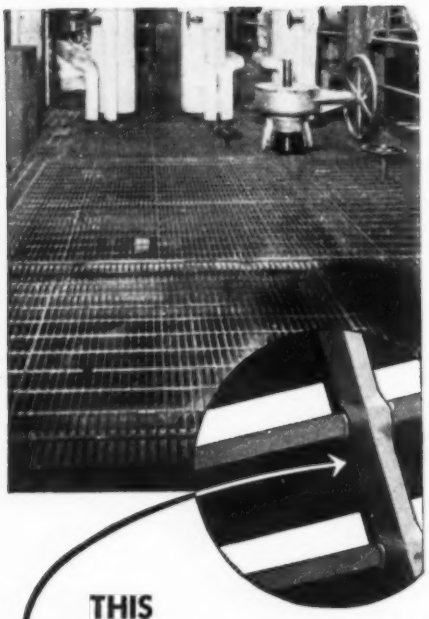


Get This New Econ-o-matic Catalog

36 pages of helpful information that shows you how to solve drive maintenance problems—how this drive can help you increase machine output. This catalog provides you with complete information on American Econ-o-matic Drives, and shows how to select the right drive for your purpose. Send for your copy. Write now.

The American Pulley Company

PHILADELPHIA, PENNSYLVANIA



THIS
SCRAPER TREAD OF
BATES-GRATES
OPEN STEEL FLOORING
GIVES THE
COMBINATION OF SAFETY AND CLEANLINESS
YOU WANT IN OPEN STEEL FLOORING

This extra cleanliness and safety come with the use of welding technique that, for years, has been recognized as the correct method to follow—a simple fillet weld.

There is no burning and no overflow of surplus metal around the fillet into which is press-welded Bates Hex Bar Stock. You get top strength and rigidity in steel flooring that permits the maximum passage of air and light.

Write for the new catalog "FILLET WELD BATES - GRATES" that gives complete details—well illustrated to show how advantages of this open steel flooring can be used in your plant.

WALTER BATES COMPANY, INC.
1707 ROWELL AVENUE • JOLIET, ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

14, 1943, the following officers were elected for the ensuing year: **J M Frank,** president; **J M Birkenstock,** vice president, and **L O Monroe,** secretary-treasurer. . . . **Four men** whose engineering ability helped to keep electric equipment moving to war plants and to the Navy recently received the **Westinghouse Order of Merit.** These men are **John A Butts,** manager of the Small Deion Breaker Dept; **Maurice H Hobbs,** manager of switchboard engineering; **Gerard H Welch,** head of the Navy and Marine switchboard design section, and **Newton S Taylor,** supervisor of the Switchgear Order Service. . . . Three General Electric men received awards at the national technical meeting of the American Institute of Electrical Engineers held in January, 1943. They are: **Dr G Wesley Dunlap** of the company's general engineering laboratory, recipient of the **Alfred Nobel prize; Gerard Swope,** president of the company who was awarded the **Hoover medal;** and **Dr Willis R Whitney,** honorary vice president and founder of the company's research laboratory, presented with the **John Fritz medal.**

OUR MEN NEED
★ **BOOKS** ★

SEND
ALL YOU CAN SPARE

GOOD BOOKS ARE ON THE MARCH from your bookshelves to our fighting men. Get them out—leave them at the nearest collection center or public library for the 1943 VICTORY BOOK CAMPAIGN.

Give a Boost with a Book—Technical books, published since 1935, in good condition, are wanted by the 1943 Victory Book Campaign for men in all branches of the service. Leave yours at the nearest collection center or public library.

In Turbine Oil,

IT IS THE
CONTAMINATION
AND
IMPURITIES
that cause
TROUBLE!

So why worry about the oil?

Eliminate the impurities and the oil will do a perfect job.

Systematic Oil Purification with a Honan-Crane "Continuous" Oil Purifier will remove acids, sludges and any other impurities that are a constant threat to safe Turbine Operation.

Why fight against all of these troublesome factors when it is so easy to remove them.

For complete information write for Bulletin 300T on Turbine and Hydro-Electric Generator Oils.

HONAN-CRANE
CORPORATION
1200 SIXTH ST.
LEBANON, INDIANA

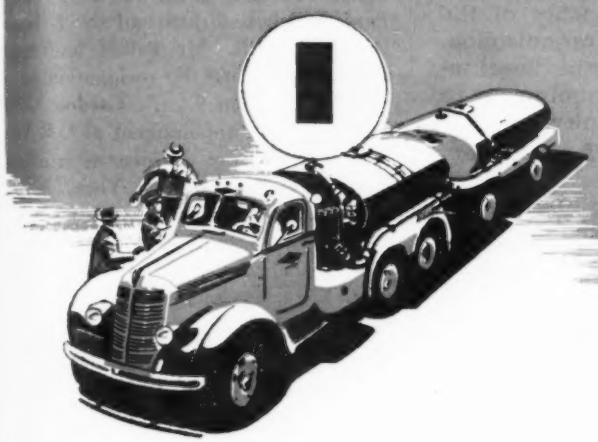
TWO BIG REASONS

WHY INDUSTRY INDORSES

DOWELL

INDUSTRIAL SCALE REMOVAL SERVICE

. . . THE SERVICE THAT SAVES TIME, MANPOWER AND EQUIPMENT



SPECIALLY ENGINEERED MOTORIZED EQUIPMENT

To provide Dowell Industrial Scale Removal Service to Industry—and eliminate the necessity of dismantling the equipment to be cleaned—Dowell operates a fleet of specially designed motorized units. This equipment—manned by competent, well-trained engineers—is equipped with special pumps, tanks and fittings for handling chemical solutions quickly and efficiently.

☆ ☆ ☆

Write Dowell's Tulsa office about your scale removal problems

DOWELL INCORPORATED
Executive Office: Midland, Michigan
General Offices: Kennedy Bldg., Tulsa, Oklahoma
Subsidiary of The Dow Chemical Company

FIELD STATIONS FOR FAST SERVICE

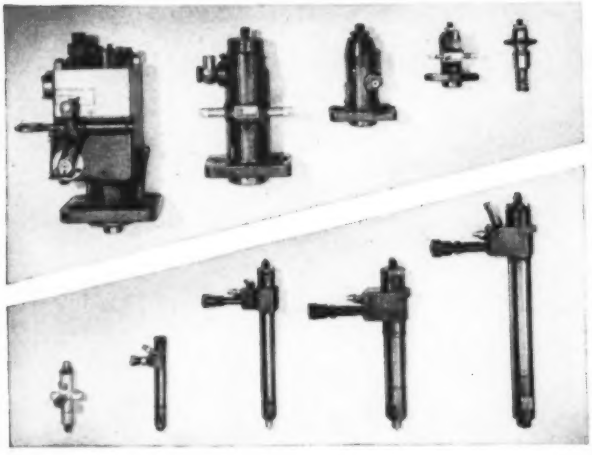
Dowell maintains field stations in many states where chemicals are stored and mobile equipment is serviced. Analytical devices are available at these stations for determining scale compositions and with this information the best type of scale removal solvent can be selected.

Look to

DOWELL

FOR INDUSTRIAL CLEANING AND SCALE REMOVAL SERVICE

YOUR GUARANTEE OF THE FINEST IN DIESEL FUEL INJECTION EQUIPMENT



In every detail, Adeco fuel injection pumps, nozzles and nozzle holders reflect the experience in precision design and workmanship of the Adeco organization, pioneers of diesel injection equipment in this country.

Today, Adeco offers a wide range of standard and special fuel injection equipment, precision-built for the most rigid diesel requirements.

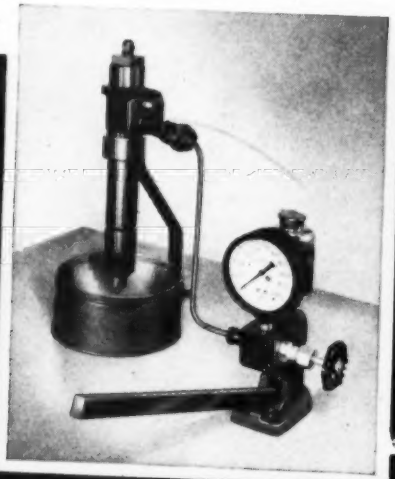
Typical of the Adeco line are the single unit fuel injection pumps and fuel injectors illustrated here. Nothing is spared to make products bearing the Adeco nameplate the finest in dependable fuel injection equipment.

VITAL FOR MAINTENANCE

ADECO NOZZLE TESTER

America's most widely used Nozzle Tester makes it easy for any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, stuck needle valves, and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests all makes of injectors. Avoids costly delays and possible damage to injector tips. Best for economical maintenance.

Write for new illustrated bulletin



AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 NORTH RAVENSWOOD AVENUE • CHICAGO, ILLINOIS

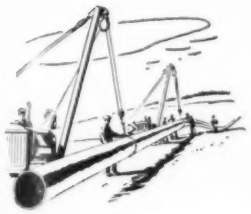
On Feb 1, 1943 **John James** started some new duties with the **Iron Fireman Mfg Co,** Cleveland after seven years as technical secretary of the **American Society of Heating and Ventilating Engineers,** New York. Mr James' responsibilities with the Society since 1935 have included the preparation of the technical data for the annual edition of **The Guide,** the correlation and administration of the cooperative research program of the ASHVE, and work with code and technical committees.

o

A tribute to the performance of diesel **engines** under most unusual operating conditions was disclosed recently when a United States cargo vessel was torpedoed in West Indies waters. After being afire and listing heavily at the bow for approximately 40 hr, two of the ship's 8 cylinder diesels, supplied by the **Cooper-Bessemer Corp,** Mount Vernon, Ohio, were found to be operating perfectly. . . . Appointment of **W R Talbot** as chief of the General Salvage Branch was announced Jan 27, 1943 by **Paul C Cabot,** director of the Salvage Division, WPB. Mr Talbot had been acting chief since the resignation of **R K White** on Jan 9. . . . **Cardox Corp** announces the appointment of **C R Van Gorder** as district engineer with offices at 233 Broadway, New York, N. Y. Prior to his New York appointment Mr Van Gorder occupied a key position in the engineering staff of the Cardox home office in Chicago.

o

For his leadership in developing standards for installation and operation of acetylene equipment and systems, **Harry E Newell,** assistant chief engineer of the **National Board of Fire Underwriters,** New York, will be awarded the **James Turner Morehead Medal** for 1941. The Morehead Medal is given annually by the **International Acetylene Association** in honor of the late James Turner Morehead, who sponsored the experiments which led to the discovery in 1892 of the modern electric-furnace method of producing calcium carbide from which the acetylene industry has sprung. The medal is awarded for outstanding work in the acetylene industry or for advancements in the production or use of calcium carbide or acetylene. . . . **E N Twogood** has been appointed engineer of the gear department of **General Electric's** Lynn Works according to an announcement by **G M Stevens,** acting works engineer. Mr Twogood succeeds **A A Ross** retired after 48 years of service with the company. . . . **The**



A Pipe Dream Comes True!

FOR YEARS men dreamed of a Super Highway—a high-pressure pipe line from the oil fields of the West to the refineries of the East.

Today that pipe dream comes true as construction swings into the final stretch on the largest and most vital pipe line ever built. It's a 1200-mile, 24-inch, high-pressure line from Texas to New Jersey, that will deliver 300,000 barrels of crude oil a day —will deliver it *fast* and *safe* from enemy submarine attacks.

Giant valves were needed for this job—valves that could take it—extreme high pressure valves that would assure *positive shut-off, easy operation, long life* and *low maintenance costs.*

That's why the Darling Valve & Manufacturing Company was selected to build these seven-and-a-half ton giants of modern industry. That's why it was so logical to specify Darling Parallel Seat Fully Revolving Double Disc Gate Valves for the largest pipe line in the world.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

Darts Have these EXTRA WIDE Matched Bronze Seats that help give them extra long life

Let's go back to Dart fundamentals—fundamentals which explain why old Dart Unions can be put back on the job—to work *efficiently* together with new Darts.

In the first place, let's consider the extra-wide matched bronze seats, ground to true-ball surfaces, that make it possible for a Dart Union to be used so many times . . . with the assurance of tightness each time. Then let's take the High-test Air Refined Malleable Iron Dart nuts and bodies that resist pipe strains, rough handling.

And to get back to fundamentals again: it *always* pays to specify Dart Unions . . . for old or new, a Dart comes through. See your supplier today . . . and keep searching your plant for *old* Darts.

DART
UNIONS
E. M. DART MANUFACTURING CO.
PROVIDENCE, R. I.

Youngstown Sheet and Tube Co has announced the appointment of **Charles W Test** as district sales manager of its Philadelphia District, with offices located at 1400 South Penn Square, Philadelphia, Pa. Mr Test's appointment fills the vacancy caused by the recent death of **H E Richardson.**

CURRENT ARMY NAVY AWARDS

The Austin Co. Award presented Jan 20, 1943.

Revere Copper & Brass, Inc, Michigan Division. Award presented Feb 6, 1943.

Crane Co. Award presented recently.

Foster-Wheeler Corp. Award presented Jan 5, 1943.

Foster-Wheeler & Co. Award presented "with star" Jan 14, 1943.

Holabird & Root and Hunkin-Conkey Construction Co. Award presented Jan 25, 1943.

Westinghouse Electric & Mfg Co, Springfield Branch. Award presented Jan 21, 1943.

R G LeTourneau, Inc. Award presented Jan 6, 1943.

Babcock & Wilcox Co, Augusta Works. Award presented Jan 22, 1943.

Fairbanks, Morse Co. Award presented Jan 21, 1943.

Fairbanks, Morse Co. Award presented to Beloit, Freeport and Three Rivers plants the week of Jan 18, 1943.

The Horni Signal Mfg Corp. Award presented Jan 7, 1943.

A sufficiency of electric power for all necessary war and civilian uses, barring the possibility of major accidents or sabotage, was foreseen Jan 26, by **Tom P Walker** of Washington, president of the **Council of Electric Operating Companies,** speaking in New York before the Conference on Defense Lighting for the National Technical meeting of the **American Institute of Electrical Engineers.** Mr Walker said, "Curtailment of electrical power is not now necessary in any section of the United States because of the lack of capacity to supply all war loads as well as civilian needs. In spite of fears, misgivings and predictions to the contrary, the electric industry to date, with perhaps two minor excep-

ROCKBESTOS A.V.C.

Provides a SURE CURE FOR WIRE FAILURES

Rockbestos A.V.C. Permanent Insulation Eliminates Repeated Wire Replacement

1. A tough, rugged, asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Inner felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to a copper-melting arc.
5. Conductor perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos

WON'T bake brittle, bloom, burn or rot
RESISTS moisture, oil, grease and fumes

Experience in countless industrial plants shows that wire failures seldom occur when Rockbestos A.V.C. is used in electrical circuits around boilers, soaking pits, furnaces, rheostats, and other troublesome "hot-spot" installations. The reason why Rockbestos A.V.C. stands up, when other wires fail, is the *permanent asbestos insulation* that won't burn, bake brittle, crack, rot, bloom or swell . . . and resists heat, corrosive fumes, oil, grease and moisture. Cure wire failures in your plant by installing Rockbestos A.V.C. in "hot-spot" circuits.

Rockbestos A.V.C. Power Cable (illustrated), Motor Lead Cable and Lighting and Control Wire (Underwriters' and N.E. Code, Type AVA) meet the requirements for severe service. Maximum operating temperature rating 110° C. (230° F.) For samples, catalog, and recommendations, write nearest branch office or: Rockbestos Products Corporation, 887 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

EVERY WILSON TUBE CLEANER CAN BE PUT TO WORK 168 HOURS A WEEK

Unlike a human being, Wilson Tube Cleaners do not need rest. They can work hour after hour without stopping—they never tire. It is all the same to them whether they work 168 minutes or 168 hours a week. They can do this week after week and year after year. This is because they have *extra ruggedness, extra speed, extra power* and *extra efficiency* designed and built into them. Put one to work and see for yourself.

There is a Wilson Tube Cleaner, cutter head, brush or other accessory for cleaning straight or curved ferrous or non-ferrous tubes of large or small diameter *faster, better* and *more economically* and saving time, tubes and trouble.

Write for the name of our representative nearest to you or send for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

THOMAS C. WILSON, Inc.

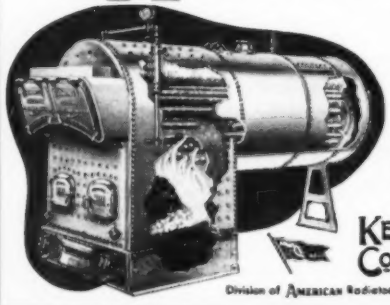
PIPE AND TUBE CLEANERS EXCLUSIVELY

THE WILSON BUILDING

21-11 44TH AVE. LONG ISLAND CITY, N. Y.

EXTRA STRENGTH...FOR HEAVY DUTY

KEWANEE



FIREBOX BOILERS

4 to 304 hp...100, 125 and 150 lbs. WP...with every characteristic which makes firebox types especially adaptable for Hi Pressure Steam..... *For 6" scale with pipe diameter markings, Write Dept. 96K-111*

KEWANEE BOILER CORPORATION Kewanee, Illinois

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

tions, has been able to furnish all the electric power necessary to supply the needs of the arsenal of democracy without the rationing which has been necessary for other products."

✪

The newly elected officers of the **American Society of Heating and Ventilating Engineers** for 1943 were installed at the annual banquet Jan 26. They are M F Blankin, **president;** S H Downs, **first vice president;** Prof C E A Winslow, **second vice president;** E K Campbell, **treasurer;** J F Collins, Jr, Prof James Holt, E N McDonnell and Lt Comdr T H Urdahl, **members of council;** and H J Rose, L P Saunders, Prof L E Seeley, Comdr A E Stacey and C Tasker, **members, committee on research.**

✪

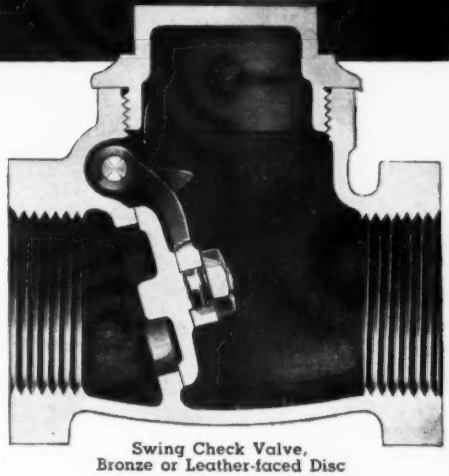
As announced Jan 17, **W G Paton,** of Cleveland, and **W R Engstrom,** of Seattle, have been made vice presidents of the **Austin Co. . . . A J M Baker** recently resigned from the British Purchasing Commission, has accepted a position as general manager of **Crocker-Wheeler Electric Mfg Co,** now a division of Joshua Hendy Iron Works. . . . **Arthur B Guise,** formerly engaged in fire and safety engineering for the **United States Rubber Co,** has joined the duGas Engrg Corp as vice president in charge of development. . . . **T O Eaton** has been appointed assistant manager of sales, power transformer section at General Electric's Pittsfield Works. . . . **J M Zimmerman,** lawyer and electrical engineer, has been named staff manager for the Pacific Coast district, manufacturing and repair dept, Westinghouse Elect & Mfg Co.

✪

Music speeds production at Westinghouse: according to a company release, war workers making motors, safety switches and small circuit breakers have music while they work, supplied by record players and amplifying systems. Tests showed, back in 1925, that music made repetitive jobs seem less monotonous. . . . **Louis Kahn** has been elected president of **Albert Kahn Associated Architects and Engineers, Inc,** following the death of Albert Kahn. Sheldon Marston, George H Miehls and Robert E Linton were elected vice presidents, George K Scrymgeour, secretary and Saul Saulson, treasurer. . . . On and after January 18, 1943, main office of **Condenser Service & Engineering Co** will be located in Seaboard Trust Bldg, 95 River St, Hoboken, N. J.

An Occupational Questionnaire for CHECK VALVES

Since valve materials are on the critical list . . . and valves are becoming increasingly hard to obtain, even by war plants . . . it is doubly important that the right valve be selected for each installation. Before deciding on a particular type of CHECK VALVE, read the following suggestions for proper application.



Swing Check Valve,
Bronze or Leather-faced Disc

WHEN MAY SWING CHECK VALVES BE USED? Swing check valves operate best on horizontal lines. If used on vertical lines or at an angle, they should be installed so that the flow will be upward through the valve.

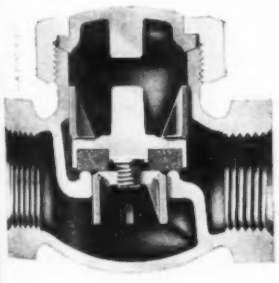
WHAT ARE THE ADVANTAGES OF LIFT CHECK VALVES? Lift check valves have less tendency to slam than swing check valves. They can be fitted with a spring to eliminate chattering and pounding where the flow is irregular or subject to quick reversal.

WHERE SHOULD VERTICAL CHECK VALVES BE USED? Vertical check valves should be used on vertical lines only, and with the flow upward through the valve.

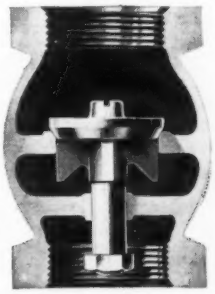
WHAT PLANTS SHOULD HAVE NON-RETURN STOP AND CHECK VALVES? Every plant using more than one boiler should have a non-return stop and check valve between each boiler and the main header. These valves are a necessary safeguard to boilers as they close automatically in case the pressure in a boiler is reduced by a tube rupture, boiler shut-down or other cause. The valve remains closed until the boiler pressure equalizes with that of the header. It then opens automatically and promptly, and can be closed manually whenever desired.

WHEN ARE COMPOSITION DISCS SUITABLE? Check valves with composition discs are suitable for pressures up to 150 lb. steam.

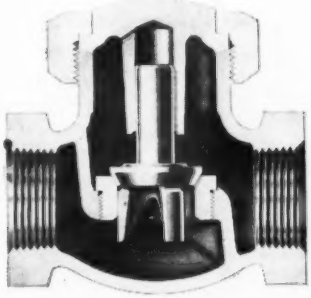
FOR WHAT SERVICES ARE METAL DISCS PREFERABLE? Metal discs for check valves are preferable for high temperatures and for severe service.



Lift Check Valve,
Renewable Composition Disc



Vertical Check Valve,
Bronze Disc



Lift Check Valve,
Renewable Alloy Disc and Seat Ring

When you are up against a valve selection problem, write us. As Kennedy makes a complete line of standard gate, globe, angle and check valves, you can be sure of receiving unbiased recommendations for the correct selection of equipment. Send for copy of the 240-page Kennedy Catalog, illustrating and describing Kennedy products.

KENNEDY VALVES • PIPE FITTINGS • FIRE HYDRANTS
THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

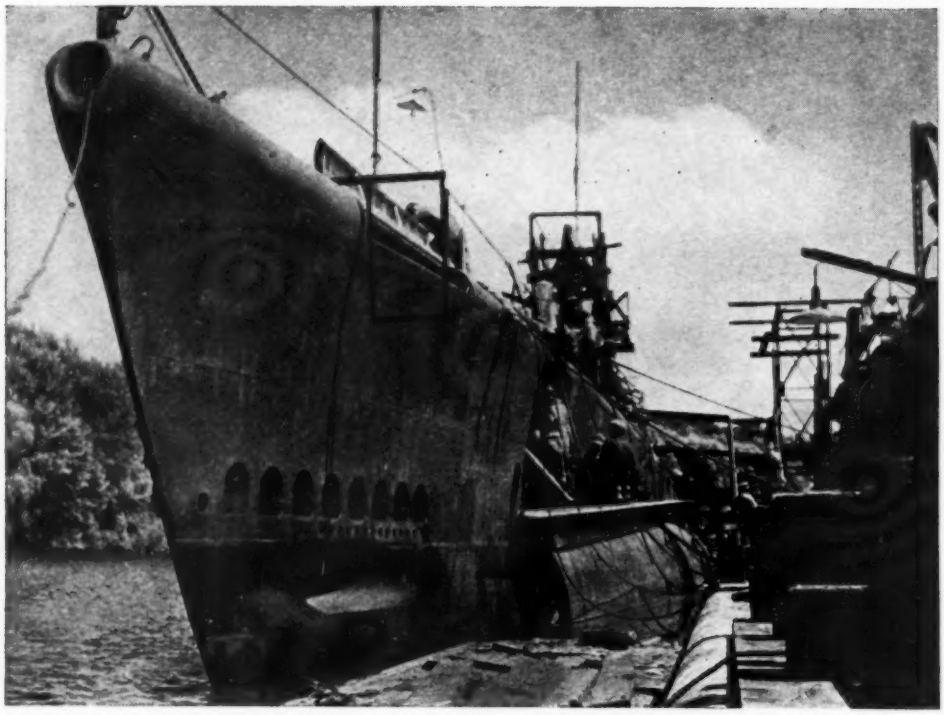


PHOTO: OFFICE WAR INFORMATION

Another American Submarine soon to be in the thick of the fighting

Everyone reading of the thrilling activities of the American submarines especially in Japanese waters cannot praise our men too highly who operate these boats.

Submarines are needed in our plan of action. In the construction and operation of every submarine considerable Industrial Rubber Products are required. Quaker is playing an important part in supplying our Government with the vital rubber products to keep these sea-fighting machines in A-1 condition.

These and many other units of the Armed Forces, as well as plants on War orders, for which Quaker is producing, have the right of way. You would not want it otherwise.

Should your order with us seem a trifle long in reaching you, your patience is requested as we are doing everything possible to spread what permissible civilian products we can manufacture equitably among our many customers.

Everyone can help during these critical days. Use all your rubber products carefully. Take care of what you already have. When its usefulness is over, send to proper rubber collecting station to be turned in as scrap. No piece of rubber is too small; old overshoes, galoshes, piece of garden hose, discarded rubber mat, hot water bottle, or any article made of rubber.

Your scrap rubber with that of other local citizens will help materially to supply the necessary rubber products needed so badly to keep the War machine in fullest operation. Thanks for your help.

INDUSTRIAL RUBBER PRODUCTS

Rubber is scarce. There is no question about that. So is coffee, sugar, meat, butter, etc. But it is not patriotic to starve to death.

Neither is it patriotic to allow your plant to lose production for want of Industrial Rubber Products.

Every plant in operation must use Rod and Sheet Packings. The Government recognizes this need. Quaker manufactures one of the most diversified lines with a Packing suitable to meet any conditions.

Consult Quaker whenever you use Packings. Our experience of manufacturing and knowledge of current regulations are at your service.

Blast the Japs out of the Rubber Pile!

KEEP ON BUYING *MORE WAR BONDS*

QUAKER RUBBER CORPORATION

OVER 58 YEARS CONSISTENT QUALITY

PHILADELPHIA · ***NEW YORK*** · ***CHICAGO*** · ***HOUSTON***

Western Territory

QUAKER PACIFIC RUBBER COMPANY · SAN FRANCISCO · LOS ANGELES

REG. U. S. PAT. OFF.

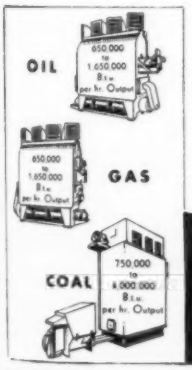
SAVING 350 TONS for—

TABULATION of Weights of one recent heating job showed that a Dravo Direct Fired system required 350 tons less of vital metals than would be required for a conventional heating plant!

A few years ago a steam plant and distributing system for heat were practically foregone conclusions when plans for industrial buildings were formulated.

Today heat produced direct by Dravo Heaters has been proved to be more, economical of materials—manhours—money—and time! It's easier to get materials when you can prove this!

Acceptance and increased use of the Dravo Direct Fired method of heating industrial buildings over the last 10 years merit the thoughtful consideration of anyone—architect—consultant—heating engineer—plant owner—purchasing agent—anyone who has anything to say about specifying or purchasing heating equipment for needed war production plants.



Complete description of construction and function of Dravo Direct Fired Heaters as well as comparison table showing savings they offer in weight, floor space and fuel consumption, will be found in Dravo Bulletin No. 506, available upon request.

DRAVO CORPORATION
HEATER DEPARTMENT
Sales Offices in Principal Cities
DRAVO BUILDING PITTSBURGH, PA.

BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received

ERNST WATER COLUMN & GAGE CO.
RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

The pre-war engineering job of planning, specifying and installing valves has changed to what might be called "re-engineering"—that is, *re*storing, *re*arranging and *re*-using valves already on hand. For this re-engineering, Ludlow is always glad to give aid. The working parts of valves, usually the first to wear out or be damaged, can in many cases be replaced and the valve put back into service. Ludlow Valves are dependable and long-lasting, and it is quite possible that old valve bodies in a store house corner may be used with the restoring of a part or two. Check up, get a priority, and send in your order. Ludlow will cooperate as always.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.

LUDLOW VALVES
SINCE 1866

THEY "ROLL WITH THE PUNCH"

They cushion the shock. They distribute the stress—evenly. They can keep on coming back for more punishment.

That's the story of the Badger Self-Equalizing Expansion Joints with the exclusive Badger

ALL-CURVE corrugation and the Badger *ALL-CURVE* equalizing ring. Together these limit and progressively control the flexing movement—*compel* the uniform distribution of stresses.

And that's what plant engineers want . . . a pipe expansion joint that won't "wilt" or crack prematurely. The corrugations of the Badger joint have no straight lines or "junctions" to take the rap of excessive localized stresses.

DIRECTED FLEXING

sums up this feature of all Badger Self-Equalizing Joints. But that isn't all . . . the *packless* feature enables these scientifically engineered joints to reduce costly shutdowns for maintenance repairs or replacements.

Badger Self-Equalizing Joints are made both of COPPER and of STAINLESS STEEL . . . of Copper for the usual heating-plant pressures and temperatures (up to 200 pounds and 500° F.); of Stainless Steel for higher pressures and temperatures—and also where corrosion is a problem. Badger was the first to develop the practical application of Stainless Steel to the corrugated expansion joint.

NON-EQUALIZING (packless) EXPANSION JOINTS

also are made by Badger, in Copper or Stainless Steel, for lines where pressures do not exceed 25 pounds and traverses not exceeding ½". Also used to absorb strains, vibrations and distortions between connecting equipment. Bulletin 200.

E. B. Badger & SONS CO.

75 PITTS STREET, BOSTON, MASS.

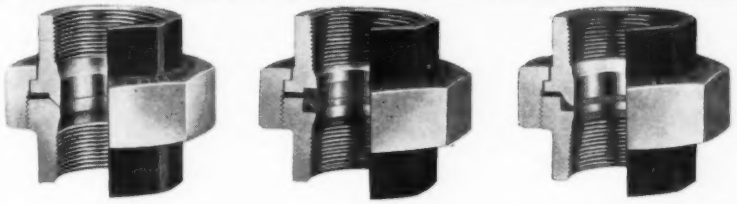
AGENTS IN PRINCIPAL CITIES

• • •

IF IT'S **BADGER**-MADE IT'S **GOT SOMETHING!**

BADGER CORRUGATED EXPANSION JOINTS

IT'S THIS KIND OF FORGED STEEL *Quality* THAT IS SO IMPORTANT THESE DAYS • •



PETRO **HYDRO** **"MARK A. A. R."**

The Bronze Seats are Completely Fused to the Steel

STEAM OR HOT OIL			COLD WATER, OIL OR GAS, NON-SHOCK	STEAM OR HOT OIL			COLD WATER OIL OR GAS NON-SHOCK
500° F	750° F	850° F		500° F	550° F	600° F	
1150 lbs.	830 lbs.	630 lbs.	2000 lbs.	1150 lbs.	600 lbs.	400 lbs	2000 lbs.

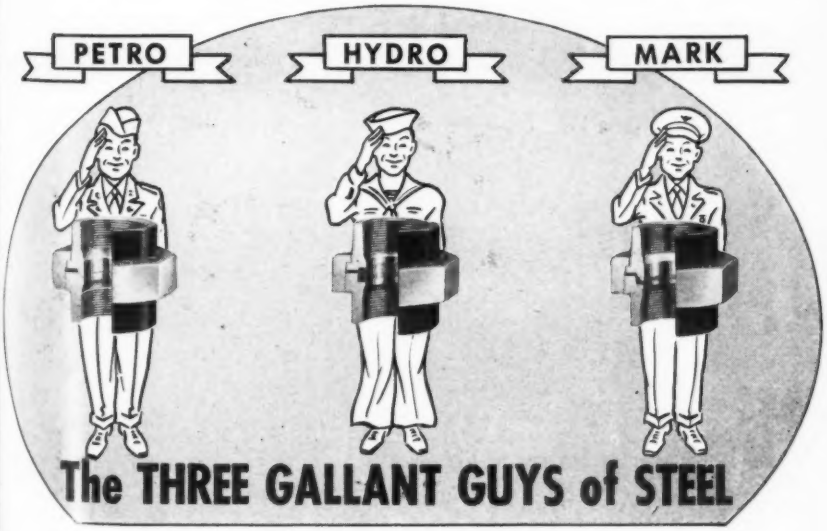
PETRO, HYDRO, and MARK began serving industry 30 years ago. Today, they are eager to serve you if you are doing essential war work.

These three gallant guys of steel have extra strength to safeguard against extreme pressures and temperatures and to insure against stretching and distortion when being made up and taken down. They also withstand the most severe pipe wrench abuse. The nut threads are permanently lubricated and rust-proofed. Order by trade name from your jobber.

Clayton MARK & Company

EVANSTON, ILLINOIS

Originators and Pioneers of Steel Unions Since 1912



The THREE GALLANT GUYS of STEEL

AT YOUR SERVICE

COCHRANE ALL-SERVICE SEPARATOR

Why the ... is the most widely used and most successful type of separator for removing oil or water from steam or air ...

1. Exceptional Port Area
2. Complete Removal of Entrainment
3. Self Cleaning
4. Purified Steam or Air Does Not Contaminate Entrainment
5. Steam or Air is Whipped Sidewise by Ports at Side of Baffle
6. High Ribbed Edge of Ports Prevents Entrainment Passing Baffle
7. Entrainment has Direct, Unrestrained Fall
8. Separating Shell
9. One Piece Construction
10. Condensate Chamber of Large Capacity
11. Provision for Gage Fittings

Write for Publication 2930

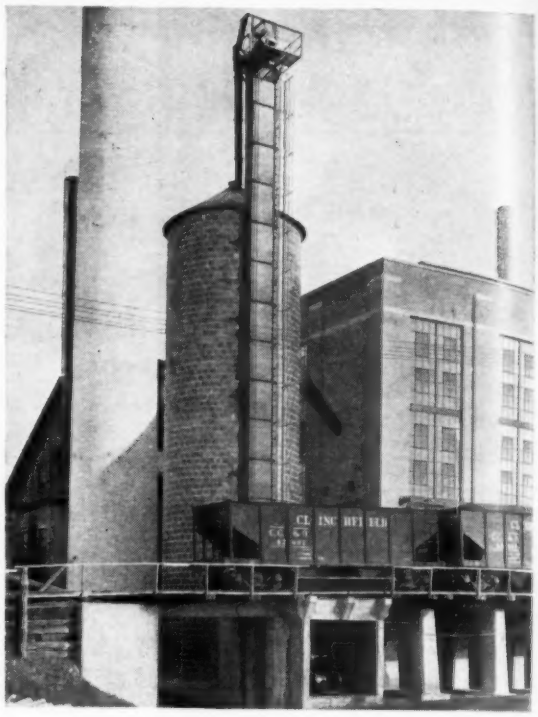
COCHRANE CORPORATION

3106 N. 17th ST. PHILADELPHIA

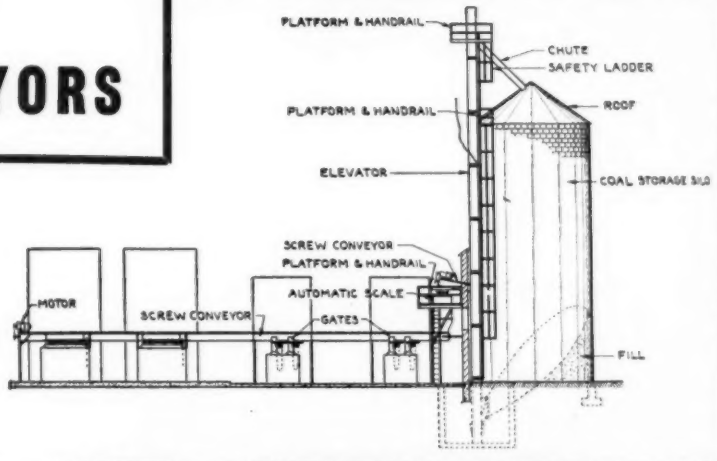
FUEL OIL HAS GONE TO WAR

KING COAL
ON THE HOME FRONT
Calls for Support

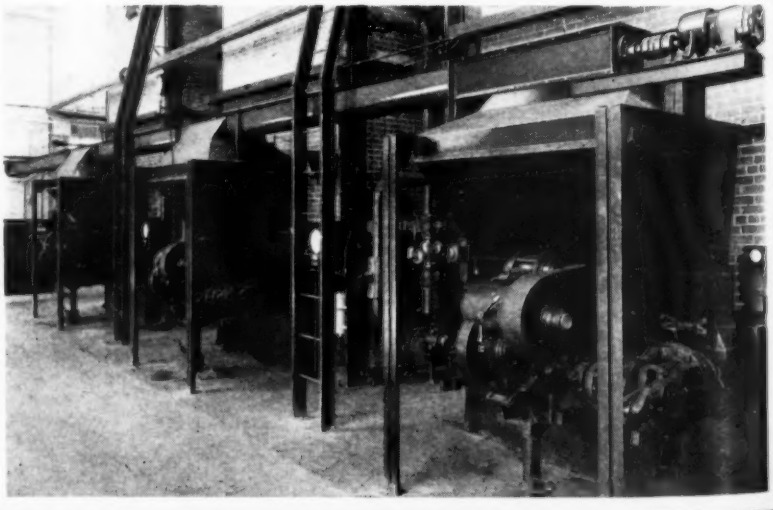
• With our huge fine oil reserve frantically inducted for the duration, old King Coal takes over more and more of the home front. And it calls for the support of the coal user—meaning it needs every facility available to your plant, to prevent every possible waste in handling, storing and conveying.



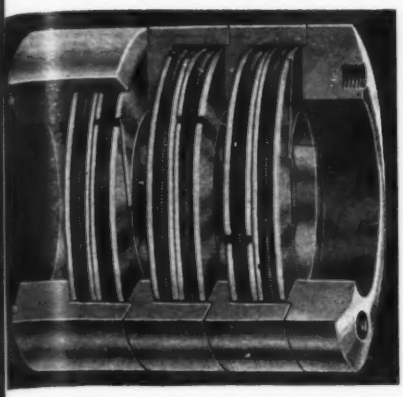
Conserve with
FAIRFIELD
SILOS AND CONVEYORS



• Perhaps your plant is another one without adequate storage facilities—perhaps you haven't the space inside the boiler house, for storage—but surely you have a 15 ft. or 20 ft. space just outside that boiler house, for a Fairfield Silo (hundreds of plants now have them). Perhaps your boiler room has no modern coal handling system. Fairfield can help you conserve coal, save money with this dual service. Look in our new catalog for many photographs and drawings of these many installations. Ask for Catalog No. 140.



THE FAIRFIELD ENGINEERING CO.,— MARION, OHIO



PRIORITY

IN PACKING PERFORMANCE

Specify France "Full-floating" Metal Packing for reciprocating piston rods as well as reciprocating or oscillating valve stems and obtain sealing efficiency of the first rank. There is a proven France design for any type of engine, pump or compressor.

- *Promotes top level production*
- *Prevents costly shutdowns*
- *Protects product uniformity*

Sold on approval Satisfaction Guaranteed

Call on *experienced* France Engineers for detailed, technical information. Write for Catalog M-7.

THE FRANCE PACKING COMPANY
Tacony Philadelphia Penna.
Branch Offices In Principal Cities

Original FRANCE METAL PACKING

WARREN PUMPS HAVE RESERVE CAPACITIES

For Increased Production Demands

EVEN though Warren Pumps are "built to fit the job"—to operate at a certain capacity—they are frequently asked to step up their capacities to meet increased production needs. *And Warren Pumps are able to meet these new demands* because of the way they have been designed and built.

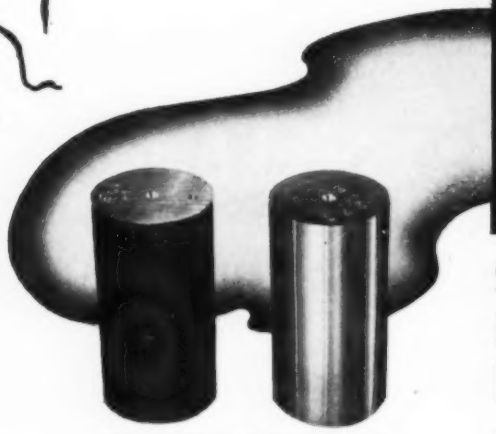
Here are some of the design-facts of a Warren Pump that helps explain its reserve capacity . . . liberal clearances between impeller and case-rings, extra-heavy shafts, over-size bearings, carefully proportioned liquid passages.

Investigate these Warren features for yourself—if you want pumps that can do *more* than their share.

WARREN PUMPS

WARREN STEAM PUMP CO., INC., WARREN, MASSACHUSETTS

The Scalpers OF TODAY



BEFORE AND AFTER SCALPING

SCALPING AT WOLVERINE is a very important procedure. Every brass block—before it is made into a condenser tube—has its skin taken off—so it can be inspected

To make sure that Wolverine Condenser Tubes are perfect, we make sure first that the block that goes to make the condenser tube is perfect.

Even in the best casting practice, there may be flaws concealed underneath the outside surface. As each billet comes from the furnace, it is cut up into blocks, and each one is put on a lathe to have the outside surface shaved off. This enables us to make a careful inspection to make certain that no imperfections are allowed to go into the extruder and finally into the finished tube.

With such close inspection of every block and with this process which compels such inspection (and does not merely assume that any imperfections will be removed by subsequent operations), the invariable result is a much more uniform, high quality condenser tube.

Uniform quality is further assured because condenser tubes, like all other Wolverine products, are controlled from ore through to finished product.

ALLOYS FOR THE ALLIES

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY

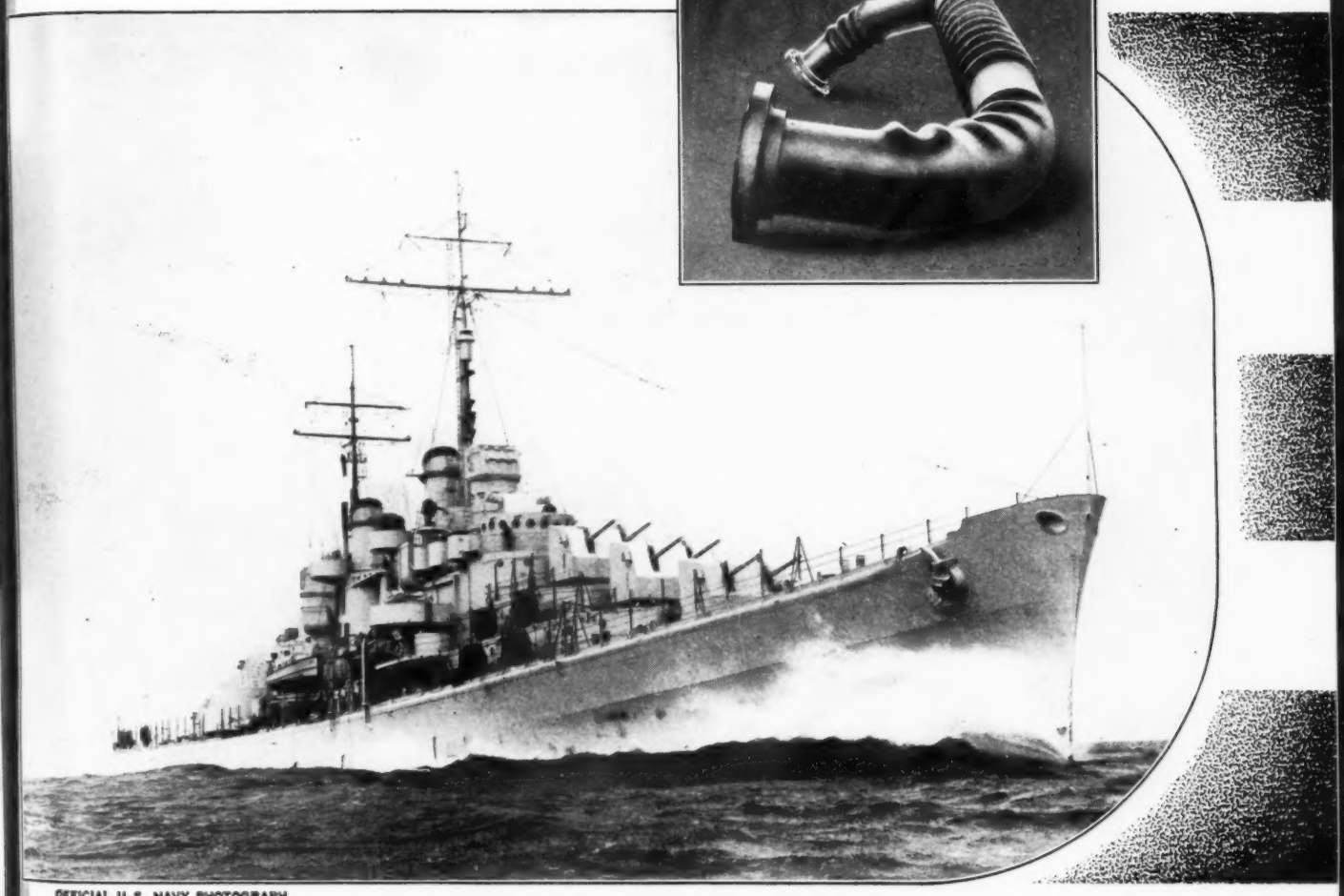
WOLVERINE TUBE DIVISION

Seamless Copper — Brass

1435 CENTRAL AVENUE DETROIT, MICHIGAN

TO COMBAT STRESS AND STRAIN USE CREASED BENDS

BY *Pittsburgh Piping* AND EQUIPMENT COMPANY



OFFICIAL U. S. NAVY PHOTOGRAPH

WHERE space is limited to an absolute minimum . . . where stresses and strains emanate from every angle . . . where active power units as well as surrounding equipment cause vibration . . . where thermal expansion and contraction are prevalent . . . where all of these conditions must be provided for in *design* and *fabrication* . . . that's where Pittsburgh Piping and Equipment Company's "Creased Bends and Corrugated Piping" have proven eminently successful through years of practical service.

Due to the *elastic* deformation of the corrugations, a properly designed corrugated tangent offers only about one-fifth as much resistance to bending as a straight pipe of the same dimensions. This unusual flexibility makes possible the use of shorter lines without excessive stresses, strains and end reactions against equipment. It also allows for more convenient location of valves and a more compact and efficient system.

If you have an unusual piping problem, have your engineer communicate with our engineering department. They have the knowledge and experience to make definite recommendations. There is no obligation.

PITTSBURGH PIPING & EQUIPMENT CO., 10 FORTY-THIRD ST., PITTSBURGH, PA.

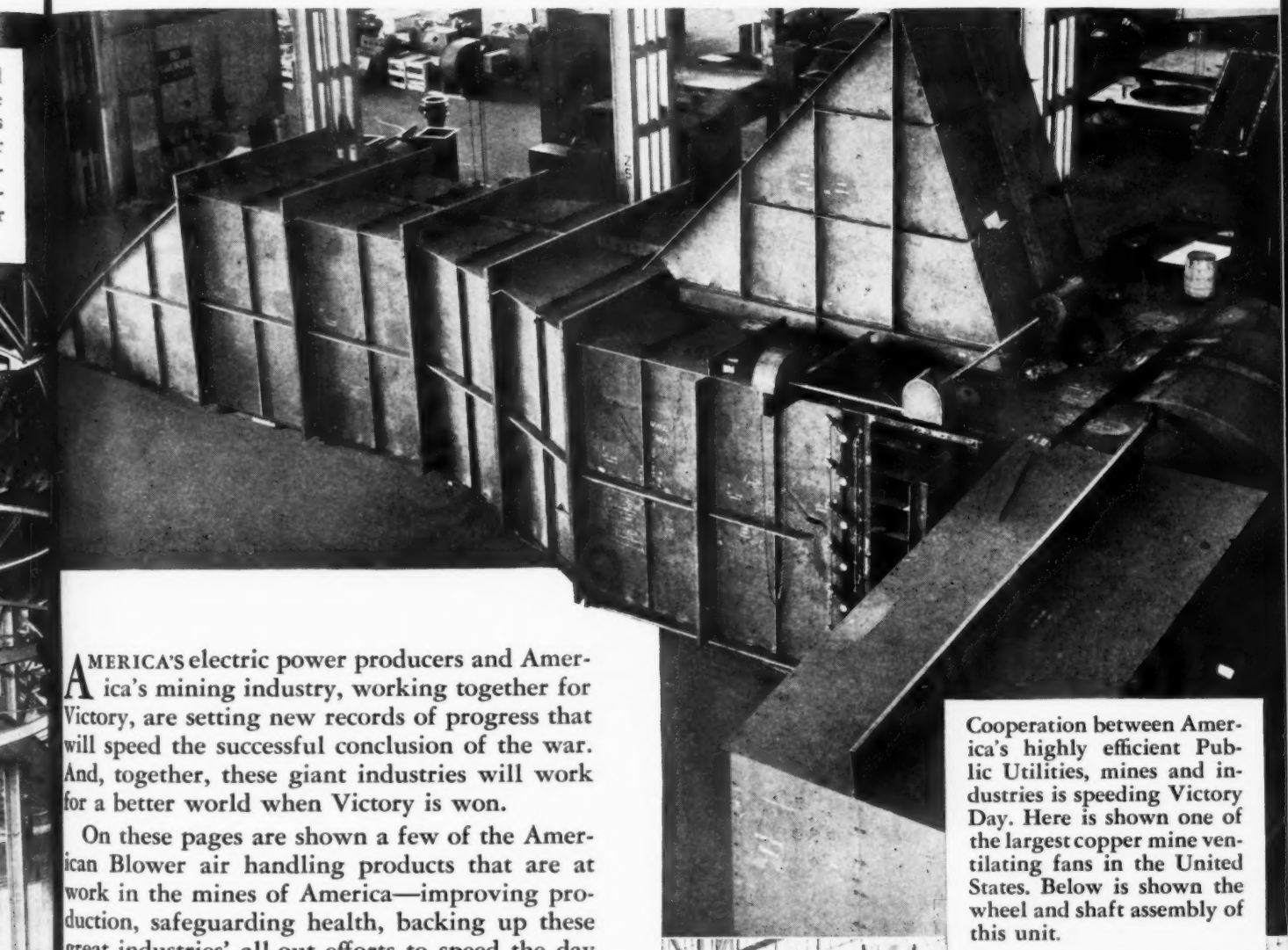
Woolworth Building, New York · · Occidental Building, Indianapolis · · Peoples Gas Building, Chicago · · Book Tower, Detroit
Public Square Building, Cleveland · · 10 High Street, Boston · · 525 Market Street, San Francisco

Progress and Power in th

The electric power generated and distributed through the far flung lines of America's Utilities drives the vital air handling equipment and machinery in the mines that supply critical metals and coal for the war effort.

A pair of American Blower Ventilating Fans for the coal mining industry.

MINING INDUSTRY



Cooperation between America's highly efficient Public Utilities, mines and industries is speeding Victory Day. Here is shown one of the largest copper mine ventilating fans in the United States. Below is shown the wheel and shaft assembly of this unit.

AMERICA'S electric power producers and America's mining industry, working together for Victory, are setting new records of progress that will speed the successful conclusion of the war. And, together, these giant industries will work for a better world when Victory is won.

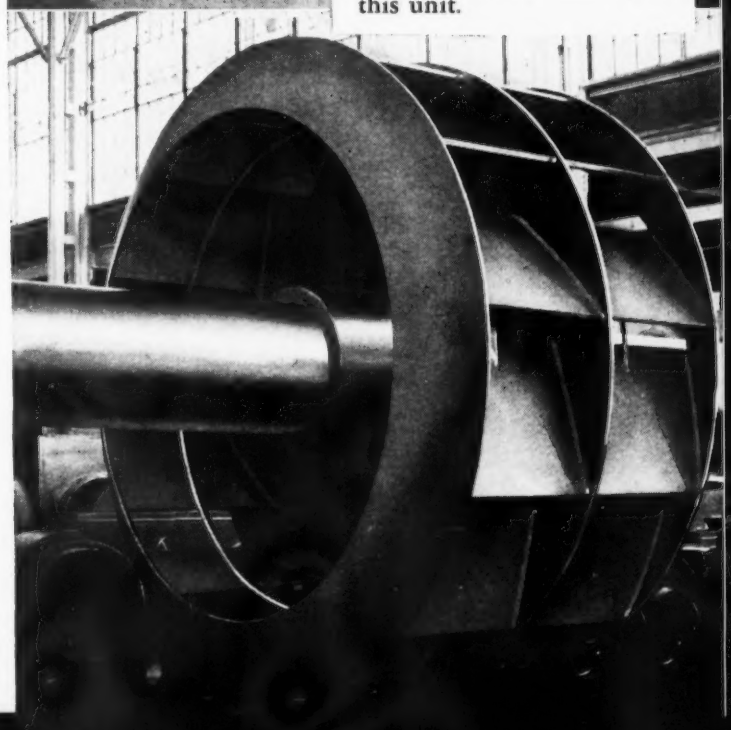
On these pages are shown a few of the American Blower air handling products that are at work in the mines of America—improving production, safeguarding health, backing up these great industries' all-out efforts to speed the day of Victory.

American Blower Mechanical Draft Fans and Fluid Drives are a familiar sight, too, in the power plants that supply the electric energy for mining. We are continuing our all-out efforts to serve the cause of Freedom on all production fronts.

ARMY E NAVY

Our plants fly the Army-Navy "E."

MECH DRAFT · AIR CONDITIONING · FLUID DRIVES · DUST COLLECTORS
AMERICAN BLOWER



AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN

CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN Radiator and Standard Sanitary Corporation

OUR ONLY CUSTOMER

Today, DELTABESTON is serving one customer—Uncle Sam. DELTABESTON Wires and Cables are used in aircraft, ships, war factories and numerous other war projects. They do the job exceptionally well . . . where other cables might fail.

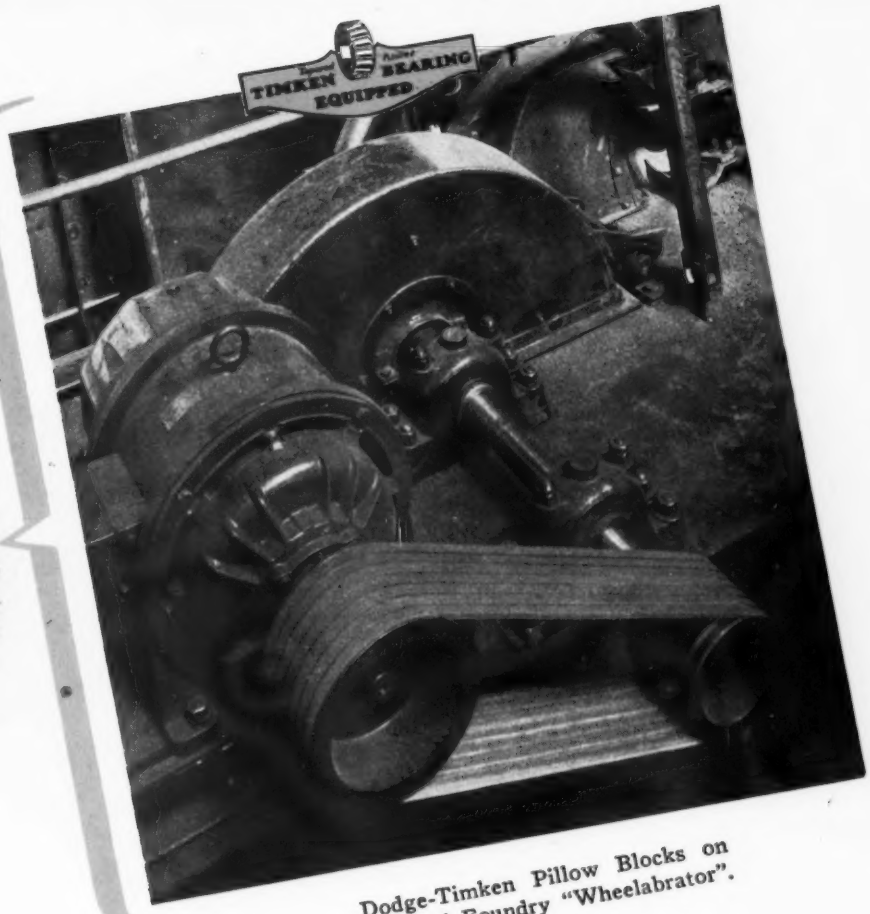
We at DELTABESTON are striving to serve our country well. Executives, engineers and factory workers are applying their combined skill and experience on one job . . . to win the war sooner. But that's not all . . .

The men at DELTABESTON have never been satisfied to let well enough alone. Our great war effort has resulted in better products, finer skills and new methods of production. These improvements will be available to you in 194X. Superior DELTABESTON Asbestos- and Glass-insulated Wires and Cables serving Uncle Sam so well today will serve you equally well when the war is over.

For additional information on DELTABESTON Asbestos- and Glass-insulated Wires and Cables, write to Section Y333-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. G-E DELTABESTON Wires and Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp. and other G-E Merchandise Distributors.

GENERAL ELECTRIC

Keep power flowing and prevent waste for Victory; use Timken Bearings in your transmission equipment. Meet post-victory conditions with greater confidence.



Dodge-Timken Pillow Blocks on drive of Foundry "Wheelabrator".

Never has the conservation of power been so imperative as now; never has it been so absolutely necessary to get power from its source to its work without loss.

It can be done — it *is* being done with line shaft hangers and pillow blocks equipped with Timken Tapered Roller Bearings.

Furthermore, Timken Bearing Equipped transmission units save shafts by preventing wear; hold them in dead true alignment and assure full protection against radial, thrust and combined loads; permit positive lubrication with prevention of lubricant leakage.

Remember, *you pay for power whether it is used or wasted.* Make sure you get full value in work for every unit of power you buy. The Timken Roller Bearing Company, Canton, Ohio.

THE ONE TEST FOR EVERY DECISION—
WILL IT HELP TO WIN THE WAR?

"All there is TIMKEN *in Bearings"*

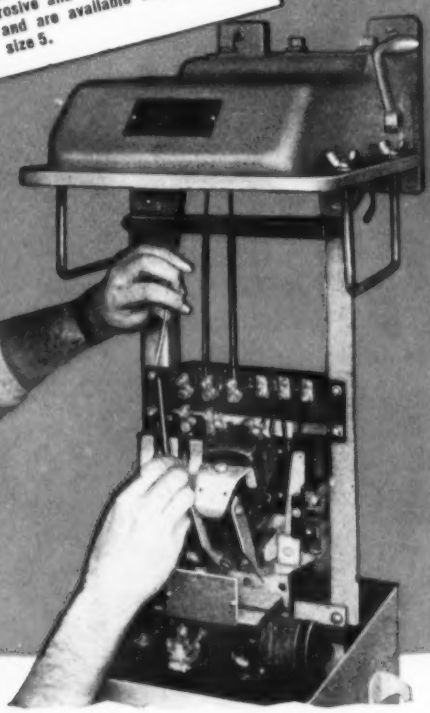
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

FOR CORROSIVE LOCATIONS These oil - immersed combinations are made in two forms—for both corrosive and hazardous locations—and are available through NEMA size 5.

DUST-TIGHT COMBINATIONS Available through NEMA size 5—these starters are for application in dusty locations—such as cement mills.

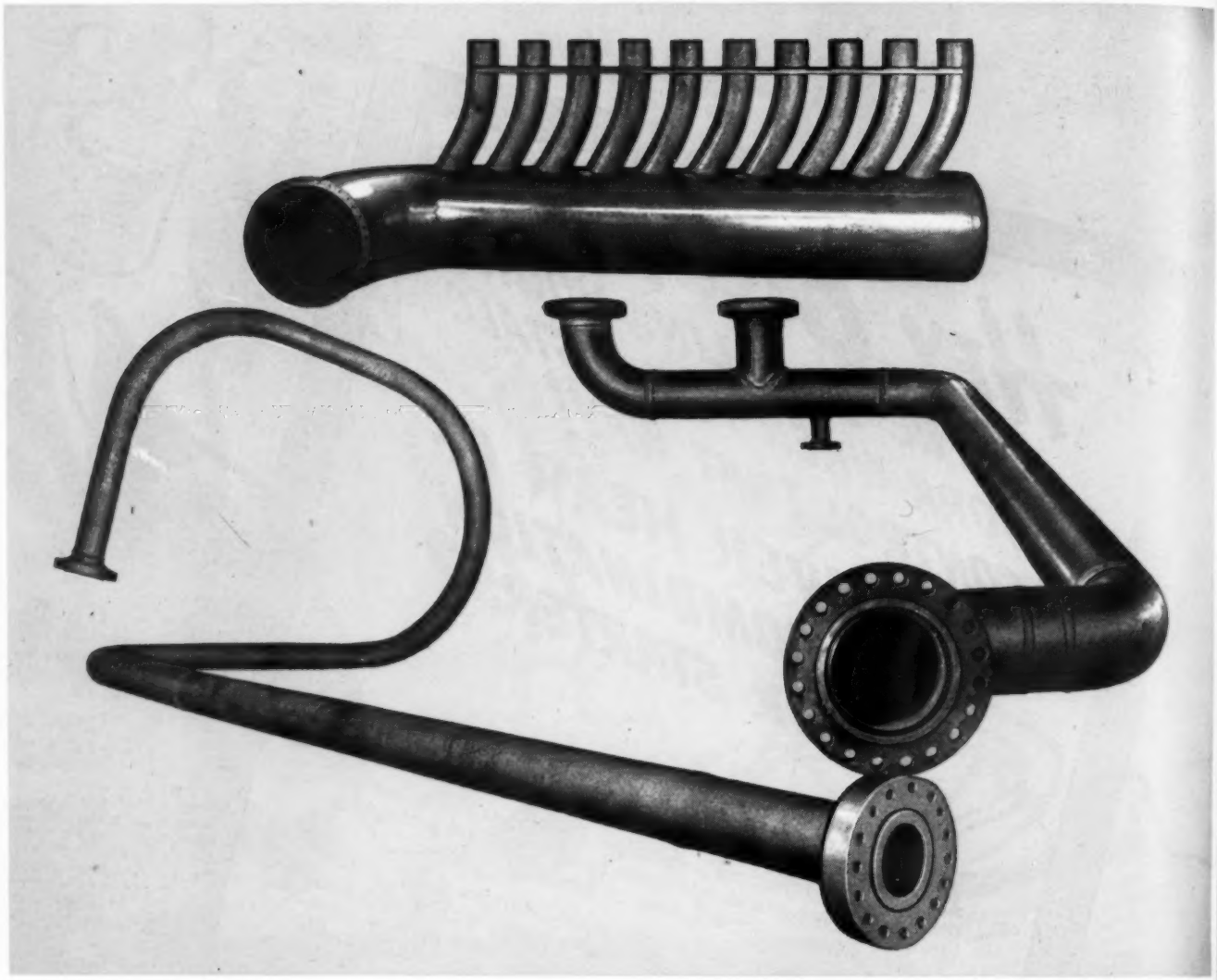
NEW HIGH-VOLTAGE COMBINATION This recently developed combination starter provides split-cycle short-circuit protection and starting means for 2300- and 4000-volt motors.



GENERAL ELECTRIC

676-93-8490

HEY BILL!
YOU'RE DOUBLING YOUR WORK WHEN YOU INSTALL CONTROL THAT WAY!
EVER HEAR OF G-E COMBINATION MOTOR STARTERS?
By using G-E combination starters, you can cut the time required to install motor control by 50 per cent. That's because "combinations" combine two controls—a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit.
But that isn't all—combination starters save critical material by eliminating unnecessary conduit; they offer your operators better protection because the case door is interlocked with the safety switch; and help you save valuable plant space by putting all necessary motor control in one case.
The next time you order motor control, save man-hours and critical material by specifying General Electric combination starters. They are available for motors from 1 to 1000 horsepower. General Electric Co., Schenectady, New York.
WATERTIGHT COMBINATIONS For outdoor application and for installation in damp locations—these starters are available through NEMA size 5.
FOR HAZARDOUS LOCATIONS Enclosed in a high-strength, alloy case, these starters are ideal for Class 1, Group D, locations. They are available through NEMA size 4.
FOR GENERAL-PURPOSE USE Available up to and including NEMA size 5—these combinations are for indoor applications where atmospheric conditions are normal.
OMBINATION STARTERS FOR MOTORS FROM 1 TO 1000 HP



PRE-FABRICATED PIPING

HELPS SOLVE THE "manpower" PROBLEM

One way to help combat the critical manpower shortage now threatening to interfere with the maximum war effort, is to specify pre-fabricated piping rather than try to build a crew for field fabrication.

Workmen employed by qualified pipe fabricators work in plants equipped with modern machinery and every other useful labor saving device. They follow carefully prepared routines and procedure controls which (together with the equipment) enable them to produce better work . . . faster . . . and with the utilization of fewer man hours.

Pre-Fabricated Piping comes to you in a series of sub-assemblies with all difficult welding done. These sub-assemblies are commercially practical, heat treated and stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Erection requires a minimum of time and labor.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

3-10

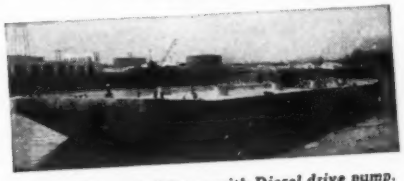
BURGESS SNUBBER BULLETIN on Diesel Exhaust Noise Control

Diesel Pumps Allow Quick Handling of Oil Cargoes

Moving large amounts of oil is one of the jobs now being done by River Terminals Corporation, New Orleans, La. Over two dozen modern tank barges, each with a nine thousand barrel capacity, are doing the job.

Discharging these big barges is done quickly by a Diesel engine-driven pump mounted on each barge. The Buda engines are equipped with Burgess Spark Arrester-Snubbers to prevent noise and eliminate the fire hazard of flying sparks.

Snubber-equipped Buda engine drives discharge pump.

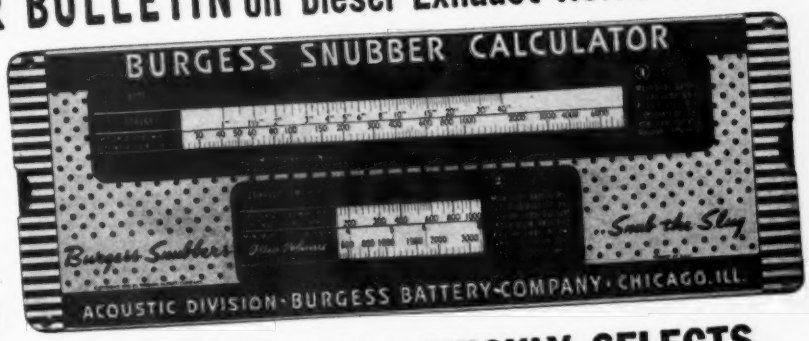


Big 9,000 barrel oil barge with Diesel drive pump.

Using Snubber Heat to Keep Plants Warm in Winter

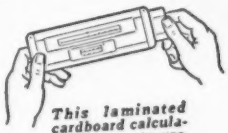
Many enterprising plant operators use the otherwise wasted heat from exhaust gases to warm their plants during the cold winter months. A very simple way to utilize this exhaust heat is shown in the picture at the right. The Snubbers here were enclosed, and openings made through the main wall into the engine room. Air passes into the Snubber compartment at the bottom and strikes the hot Snubber. This heated air is then carried back into the engine room through an opening near the top. An outside opening is provided for ventilating the Snubber during warm summer months.

Power plant at Plattsburg, New York



NEW SLIDE RULE QUICKLY SELECTS PROPER SIZE SNUBBER

To supplement the regular recommendation sheets which are available for most engines, Burgess engineers have devised a new computing slide rule which quickly indicates the proper Snubber for use on any given engine application. While it is not intended to take the place of the specialized engineering which is often necessary with a difficult problem, it will enable designers and operating engineers to save time in making preliminary estimates. On most applications, the Snubber can be specified by means of this device.



This laminated cardboard calculator is easy to use.

Engine Data Needed

The rule incorporates four different scales, two on each side. By starting with scale one and working down to the last scale which makes two final computations, it is easy to select the correct Snubber for the job. The following must be known: number of cylinders, whether a two- or four-stroke cycle engine, bore, stroke, volumetric efficiency, exhaust temperature, and rpm. The first three scales compute the gas volume in cfm, and scale number four shows the size Snubber needed according to the average velocity of the gas. The illustration above shows scales number one and two.

The two main factors involved in the selection of a Snubber are: (1) the volume of exhaust gas passing through the Snubber and (2) its average velocity.

In order to see how this slide rule operates, let us take an example. On a given one cylinder, two-cycle engine with 4¼" bore, the stroke is 5". The first step is to set the stroke (5") beneath the bore (4¼"). When this is done, the operating piston displacement per cylinder in cubic inches can be read off the lower part of the same scale, above the operating volumetric efficiency. If we take volumetric efficiency as 130%, piston displacement is 92 cu. in.

Next, we set the 92 cu. in. displacement beneath the proper exhaust temperature on scale two. Suppose this is 700°F. The volume of the exhaust slug (the amount of gas ejected from each cylinder during each cycle) is then shown as 200 cu. in. At this point a red figure on this scale tells us that a 2½" Snubber is the minimum size which could be used. However, it is necessary to take into account the number of cylinders and the velocity of the exhaust gas in order to be sure this will be the right size. Therefore, we must carry our calculations further.

Finding Total Gas Volume

On scale number three, the slug volume of 200 cu. in. is moved below the number of cylinders, in this case "one." Supposing the rpm to be 1,200, we will then look above the mark on the slide rule which indicates 1,200 and find that the volume of exhaust gas is 140 cubic feet per minute.

On the number four scale, 140 is placed below an arrow marked "two-cycle." If this were a four-cycle engine, we would use the arrow marked "four-cycle."

Now we are able to see that with a 2½" Snubber, as indicated on scale two, the velocity of the exhaust gas is approximately 4,000 feet per minute. The table at the left of scale four gives the velocity range for this type and speed engine as 7,000-9,000 fpm, so that we are well within this limit. While a velocity of 7,000-9,000 fpm would seem to indicate the use of a 2" Snubber, our calculations of *slug volume* on scale two show that this would be too small. Therefore, the 2½" Snubber is the correct one.

If an average velocity less than 4,000 fpm is desired, a Snubber larger than 2½" must be used.

Slide rules of this type will be furnished free of charge to engineers and operators who request them.

Published by ACOUSTIC DIVISION, BURGESS BATTERY COMPANY — 2823-L W. Roscoe St., Chicago, U. S. A.

COPYRIGHT, 1942—BURGESS BATTERY CO.

S—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGI

MPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR C

How COST CAPITALIZATION TURNED A HIGH BID INTO A LOW ONE

-AND SAVED A PRITCHARD MECHANICAL DRAFT BUYER- THOUSANDS OF DOLLARS

Why Pritchard Towers Save You Money

1. High Efficiency, Light Weight, Non-Corrosive Monel Fans. Pritchard fans are the heart of Pritchard tower efficiency and economy. Their superior design and construction saves tremendous amounts of horse power over a period of years. Blades have a special twist and taper that gives a steady, uniform air flow through the entire fan opening.

The use of non-corrosive sheet monel over a light, strong framework cuts weight to half that of cast alloy — ends corrosion and pitting troubles. Larger blades, and often fewer of them, move the required volume of air with less fan speed and less fan power. Pritchard fan drive design and fan housing design, particularly in induced draft towers, contribute further to fan efficiency and horsepower economy.

2. Low Pumping Head. Closed pipe water distribution through gravity sprinklers cuts down frictional resistance; saves pump power for lifting; sometimes even permits building higher towers without waste.

3. Liberal Size and Rating. Any "skimping" on capacity must be made up by an extra load on fans or tower efficiency will suffer. Pritchard towers ase sized and rated to permit low air velocities and consequent lighter fan loads.

Further details on request. Write for them.

On a certain large mechanical draft cooling tower job not long ago the Pritchard *price* was $8000 high. But on a cost and operating capitalization over a period of five years the Pritchard tower showed a saving of several times that amount.

That is just one instance. There have been many others where Pritchard towers, because of their *operating economy*, have made first cost of secondary importance.

If you will purchase mechanical draft equipment on a cost capitalization basis, Pritchard towers will almost invariably save you money. Read the reasons why in column on left. Get Pritchard figures before you buy.

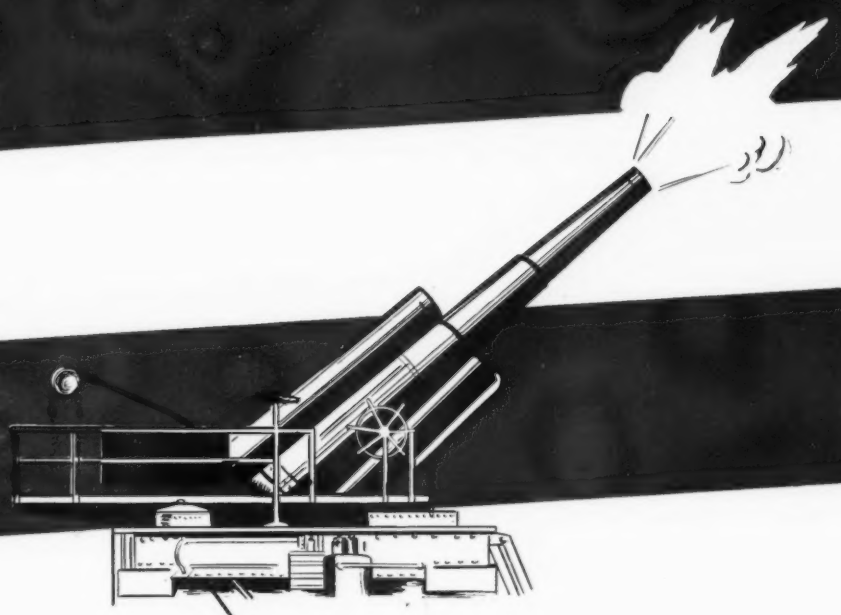
J. F. PRITCHARD and COMPANY
FIDELITY BUILDING KANSAS CITY, MO.

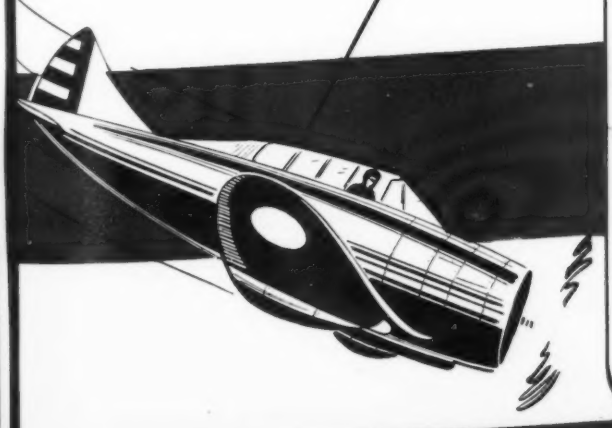
Branch Offices in Tulsa, Okla.; Houston, Texas; Atlanta, Ga.; Chicago, Ill.; Pittsburgh, Pa.; New York City

PRITCHARD

Atmospheric and Mechanical Draft

WATER COOLING TOWERS





BENJAMIN F. SHAW CO.
answers the demand
"GET IT DONE!"

"Needed fast are new plants . . . expansion of old ones . . . to meet America's great war needs for Explosives, Synthetic Rubber and 100 Octane Aviation Gasoline.

"In this vital construction work, piping for processing—piping for power generating stations—piping of all sorts, shapes, sizes and built to stand all types of pressures and temperatures is essential.

"This piping has to be fabricated—(that is—bent, flanged, welded, heat treated, in short, custom-built to fit the individual job)—then it has to be installed.

"And it must be done quickly—efficiently.

"Benjamin F. Shaw Company has been engaged 100% in this vital war work for months—is working today every hour of the day, every day of the week on it.

"In its piping prefabrication jobs all over the country approximately 5,000 men under the direction of Shaw engineers are answering the demand 'Get It Done'.

"And a great majority of these Shaw workers are investing regularly out of each pay in War Bonds."

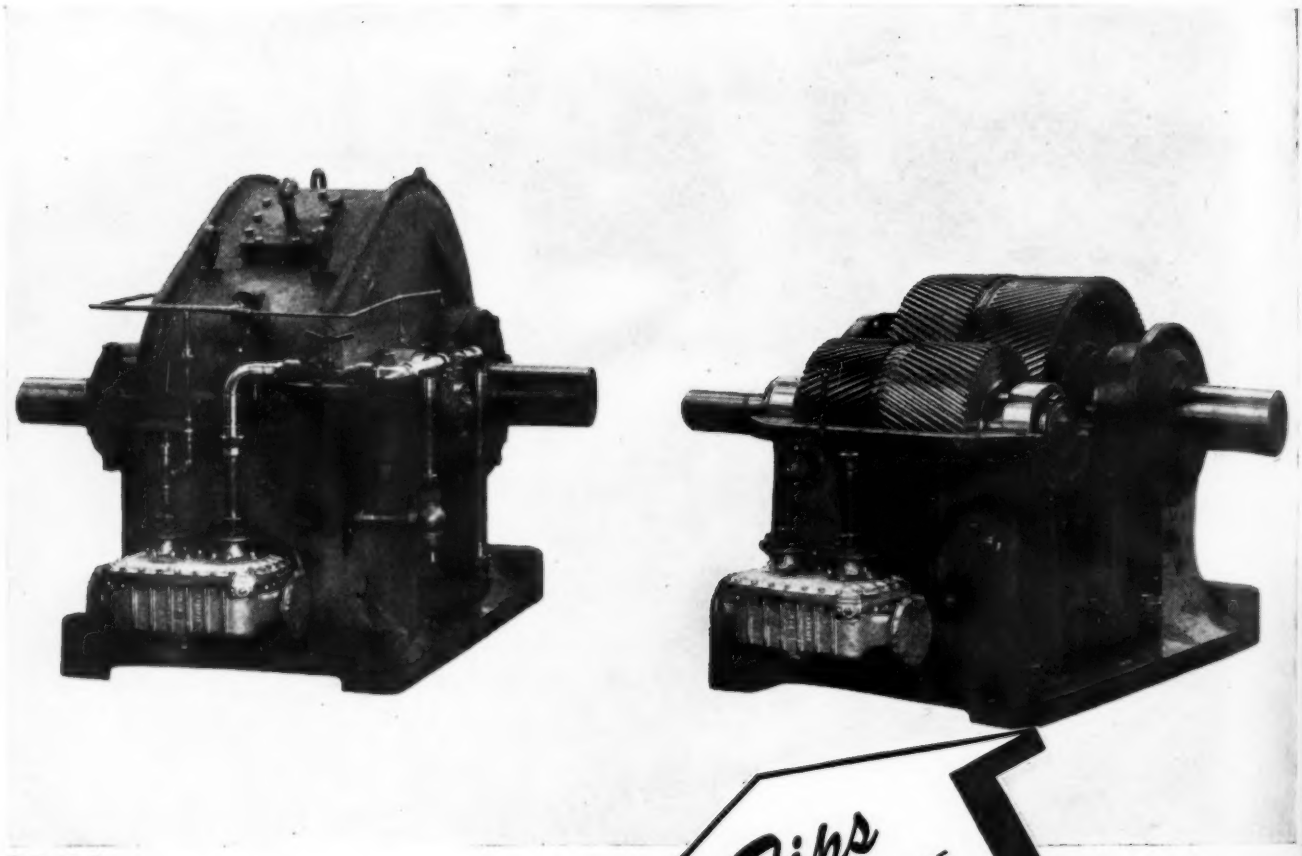
President

BENJAMIN F. SHAW COMPANY
2nd & Lombard Sts. Wilmington, Delaware
Piping Fabricators, Contractors & Distributors

50th Anniversary Year

BACK OF *the power behind production:*

SKF-*EQUIPPED SPEED INCREASERS*



● *Built by*
PHILADELPHIA GEAR WORKS

Providing the power and proper speeds that enable machines to produce weapons for Victory is a big job these days. But it's a job made easier through the use of this Speed Increaser which, driven by a water wheel driving generator, transmits 1800 h.p. continuously at 685 r.p.m., input, and 1200 r.p.m., output. That this machine has SKF-equipped gear and pinion shafts is assurance of the smooth, steady transfer of power at increased shaft speeds. Built like a giant to do the work of a watch, SKF's are wings for the shafts that keep Production UP.

5258

SKF INDUSTRIES, INC., PHILA., PA.

Tips
ON BEARING CARE
To make present equipment last longer

1. Use clean lubricant recommended by the manufacturer of this machine.
2. Avoid loads and speeds beyond those recommended by the manufacturer.
3. If necessary to remove bearings, keep them properly lubricated. Avoid the intrusion of water and dirt. Apply pressure on the inner race only. Don't hammer outer race.

SKF
BALL AND ROLLER
BEARINGS

BUY U. S. WAR BONDS AND STAMPS

THE ANCHOR PACKING COMPANY

MANUFACTURERS—DISTRIBUTORS

METALLIC & FIBROUS PACKINGS FOR EVERY PURPOSE

GENERAL OFFICES

PHILADELPHIA, PENNSYLVANIA

FACTORIES: MANHEIM, PENNSYLVANIA • ELKHART, INDIANA • MONTREAL, CANADA

BRANCH OFFICES

Baltimore, Maryland	106 Stewart Building Gay and Lombard Streets
Boston, Massachusetts	303-04 North Station Building 150 Causeway Street
Buffalo, New York	Andrews Building
Cleveland, Ohio	523-25-27 Rockefeller Building
Chicago, Illinois	200 East Illinois Street
Cincinnati, Ohio	4 West 7th Street
Detroit, Michigan	169 West Jefferson Avenue
Houston, Texas	509 Washington Avenue
Kansas City, Missouri	1332 Oak Street
Los Angeles, California	720 Mateo Street
Montreal, Canada	5575 Cote Saint Paul Road
Milwaukee, Wisconsin	4417 West North Avenue
New Orleans, Louisiana	418 Common Street
New York, New York	100 Sixth Avenue, near Canal
Philadelphia, Pennsylvania	401 North Broad Street
Pittsburgh, Pennsylvania	405 Penn Avenue
Portland, Oregon	Terminal Sales Building
San Francisco, California	156 South Park
Seattle, Washington	2207 First Avenue, South
St. Louis, Missouri	1407 Pine Street
Tulsa, Oklahoma	823 South Gary Place
Wilmington, California	207 Avalon Boulevard

AN IMPORTANT NOTICE TO ALL USERS OF COOLING TOWERS

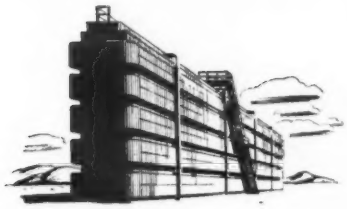
from the

COOLING TOWER DIVISION OF THE FLUOR CORPORATION LTD.

2500 South Atlantic Boulevard, Los Angeles, California

1919 R.C.A. Building, New York City, N.Y. · 545 William Penn Way, Pittsburgh, Penna. · 703 Fairfax Building, Kansas City, Mo. 1501 Mellie Esperson Building, Houston, Texas.

SINCE 1890



THE EFFECT OF CRITICAL COMPONENTS LIMITATIONS ON DELIVERY OF COOLING TOWERS

CRITICAL components limitations are exerting a sharp, industry-wide effect on delivery of cooling towers and they will continue to do so with increasing severity for the duration. In the interest of enabling users of cooling towers to secure the most prompt delivery, we feel an obligation to point out that critical components limitations are exerting a more pronounced effect on delivery of Mechanical Draft types while, for reasons stated herein, Fluor Atmospheric Aerator Cooling Towers can be delivered on schedule. Here, in Questions and Answers form, are the reasons why your interests will best be served if you specify Fluor Atmospheric Aerator Cooling Towers in every possible instance for the duration:

Q.: *"Why are Atmospheric Aerator Cooling Towers less affected by critical components limitations than Mechanical Draft types?"*

A.: Atmospheric Cooling Towers use the absolute minimum of critical materials. They do not require electric motors, reduction gears, propeller fans, fan rings, fan guards, motor supports, electric wiring or conduit which are the absolute essentials of the Mechanical Draft types. Many thousands of man-hours and machine-hours are required for the manufacture of this auxiliary equipment and critical transportation space is required for shipment from sub-manufacturers and reshipment to the job.

Q.: *"What positive delivery guarantee can be given when Mechanical Draft types are specified?"*

A.: As against an Atmospheric tower of comparable capacity, the absolute minimum required is twice as long and even this cannot be positive since the production of motors, fans, gears, etc., is always in greater part or absolute whole in the hands of sub-manufacturers and final delivery of the tower is dependent upon the ability of such sub-manufacturers to make their deliveries.

Q.: *"What positive delivery guarantee can be given when Fluor Atmospheric Aerator Cooling Towers are specified?"*

A.: As against Mechanical Draft types of comparable capacity, Fluor Atmospheric Aerator Cooling Towers can be delivered in one-half to one-third the time.

Q.: *"Will a Fluor Atmospheric Aerator Cooling Tower give performance efficiencies identical with those of the Mechanical Draft types?"*

A.: Yes, in the vast majority of cases. Of the minority cases, there are many instances where the difference in efficiency will be so slight as to make the Atmospheric type entirely suitable for wartime use. In the extremely few remaining cases, a Mechanical Draft type is the only answer.

Q.: *"What are the limiting factors which make specification of a Mechanical Draft type absolutely mandatory as in the aforementioned few remaining cases?"*

A.: The only limiting factors making specification of Mechanical Draft types absolutely mandatory are (1) lack of space for the erection of the Atmospheric type and (2) extremely subnormal wind conditions.

Q.: *"How can we be certain that a Fluor Atmospheric Aerator Cooling Tower is the absolute, correct specification under any conditions; or, if it is a substitute specification made necessary by wartime conditions, how can we know in advance just what the efficiency difference will be?"*

A.: Fluor engineers will gladly give specific, unbiased answers to either question after analysis of your problem. Fluor manufactures ALL types of cooling towers and holds no brief for either type; thus, our thinking is completely independent.

Q.: *"If analysis shows that a Mechanical Draft type is the only answer to our problem, what can be done?"*

A.: Fluor will gladly cooperate by furnishing expert documentary evidence of essential need as a means of assisting you in obtaining the necessary directive.

Q.: *"Has the development of the Fluor Atmospheric Aerator Cooling Tower kept pace with the development of Fluor Mechanical Draft Cooling Towers?"*

A.: Yes. As manufacturers of ALL types of Cooling Towers, Fluor has always recognized the fact that each type has a definite place in the field of efficient water cooling. Fluor has constantly conducted research with a view to improving both types. Typical of Fluor's development of the Atmospheric type is the patented Fluor Aerator which distinguishes this type from the old "louvre" towers and reduces water loss from windage to a point comparable with the best designed Mechanical Draft types.

Q.: *"Under current conditions, can Fluor deliver an Atmospheric Aerator Cooling Tower promptly on schedule?"*

A.: Yes! Through the entire Defense Program and now under wartime conditions, Fluor never once failed to deliver either ahead of schedule or on time! Today, Fluor is manned, tooled and stocked to continue this record!

Q.: *"What is the answer to Fluor's ability to meet delivery schedules promptly?"*

A.: Fluor was first to recognize the importance of standardizing cooling tower design and only Fluor 100% prefabricates cooling towers before shipment from the mill to the job. This results in saving countless man-hours in fabrication and erection.

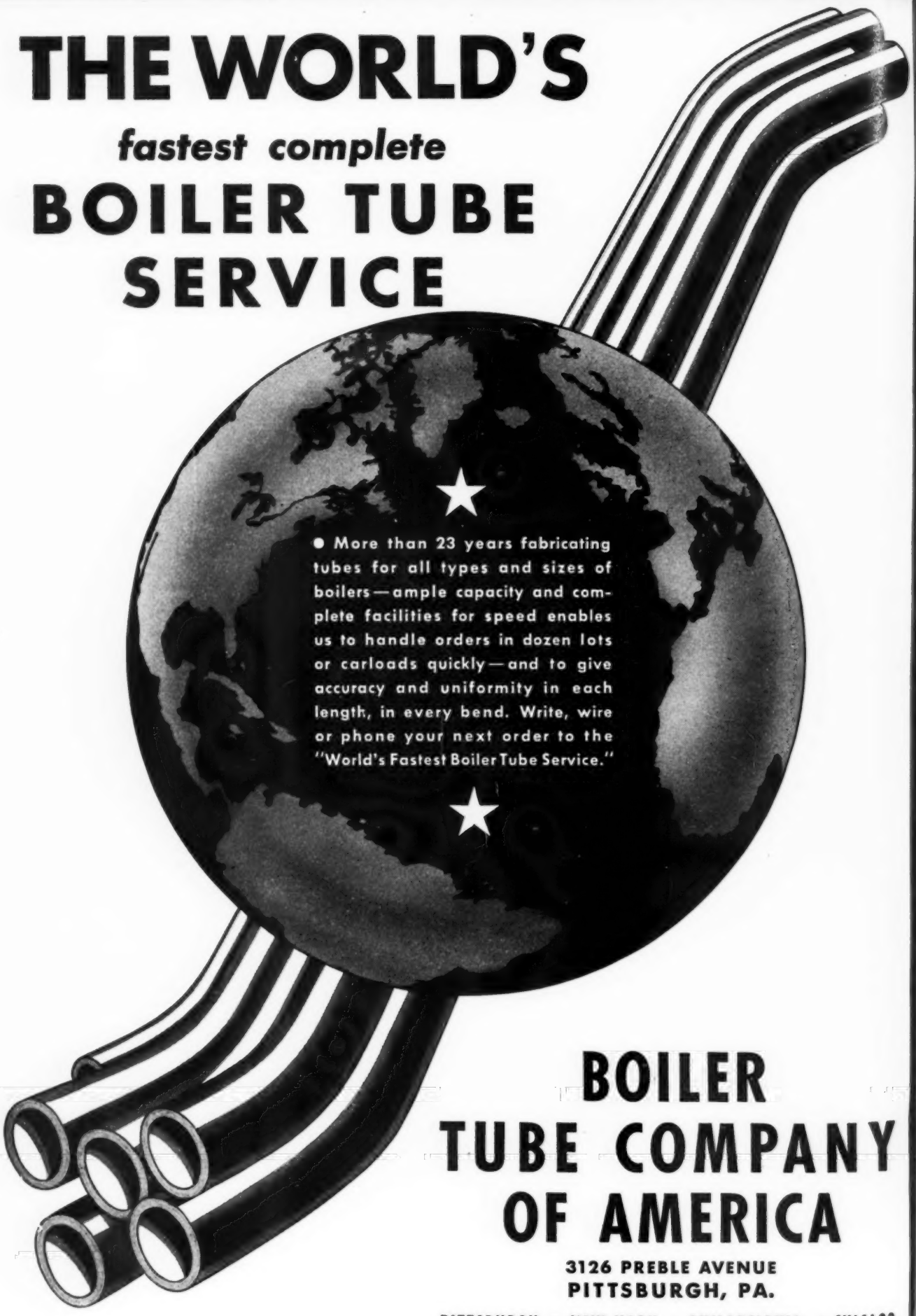
★ ★ ★

These, then, are the reasons why Fluor recommends specification of Atmospheric Cooling Towers for the duration. Wire or air mail your inquiries or order for instant action. *Be Sure With Fluor!*

ATMOSPHERIC AERATOR & MECHANICAL DRAFT COOLING TOWERS

FLUOR

THE WORLD'S
fastest complete
BOILER TUBE SERVICE



● More than 23 years fabricating tubes for all types and sizes of boilers—ample capacity and complete facilities for speed enables us to handle orders in dozen lots or carloads quickly—and to give accuracy and uniformity in each length, in every bend. Write, wire or phone your next order to the "World's Fastest Boiler Tube Service."

BOILER TUBE COMPANY OF AMERICA

3126 PREBLE AVENUE
PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO
FRED S. RENAULD & CO. • LOS ANGELES

TOUGH NUTS TO CRACK

LOCKED in place on bolt by grip of tough locking collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents axial play
FITS any standard bolt. Made in all sizes and types

● We've made billions of Elastic Stop Nuts.

And to our knowledge not one has failed to do its job.

But the tough nuts we refer to now are the fastening problems which looked hopeless until Elastic Stop Nuts were used.

We've met lots of these in our day — and licked them.

There have been plenty of them in war production.

And how well these fastenings have filled the bill can best be told this way:

Every nut we can possibly produce is going into war goods. Yet even doubling our round-the-clock plant capacity hasn't let us gain on the demand.

In the days to come there will be many peacetime needs for these nuts.

Some will be simple. Others will look like "tough-nuts to crack."

Our engineers like to meet both kinds. They stand ready to share their experience with you, work on your fastening problem and recommend the proper Elastic Stop Nut application for the job.

ELASTIC STOP NUTS

Lock fast to make things last

ESNA TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY

LOOK FOR THE WINNING DIAMONDS

WATSON-STILLMAN

Distributor Products Division

Engineers and Manufacturers of Forged Steel Fittings and Valves, Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps, Jacks.

ON forged steel fittings and valves, the Watson-Stillman trade-mark affords the kind of protection you need today. Its two diamonds and its W-S Symbol assure the right answer to the question "Am I buying products of the highest quality?"

Watson-Stillman engineering leadership is reflected in every double-diamond unit you use. Authoritative factual data give the "know-how" necessary to get the most value from the choice of correct equipment. Ask for free bulletins on the product in which you're specially interested. The Watson-Stillman Company, Roselle, N. J.

Watson-Stillman forged steel fittings and valves are available to essential war industries through mill supply distributors.

Guard YOUR turbines with this oil that's

FIGHTING with the FLAT-TOPS

FROM THE LAND "DOWN UNDER" to the fog-bound north the mighty turbines in scores of U. S. Naval units are being lubricated by new, rust-preventive Shell Turbo Oil.

These turbines run under a wide variety of loads. The oil, which is constantly in contact with air and, frequently, water, must lubricate bearings, gears, governor. It's one of the toughest turbine lubrication assignments there is. But new, rust-preventive Shell Turbo Oil can handle it.

The secret is in the fact that it has *all* 3 vital requirements necessary to the proper lubrication of modern turbines:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Call in the Shell man now. Let him show you why it will pay you to use the new Shell Turbo Oil.

SHELL TURBO OIL

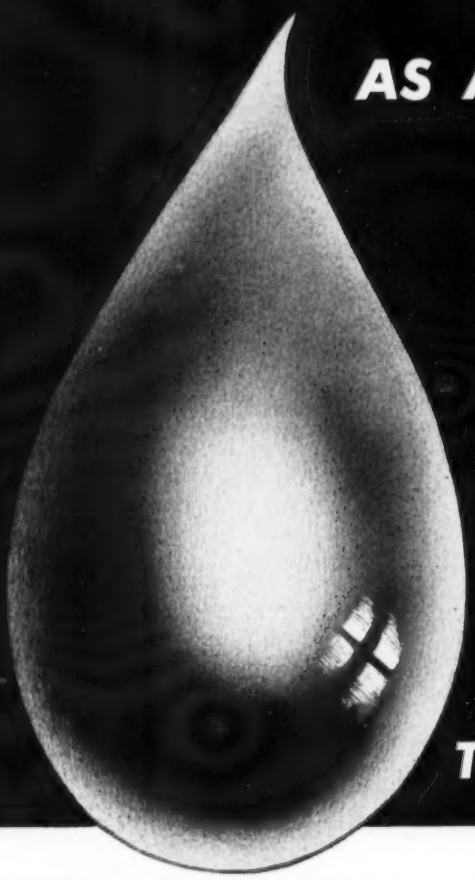
A name to Remember

OIL IS Ammunition -USE IT WISELY

SHELL

DAMAGING

AS A "BLOCK BUSTER"



TO VITAL PRODUCTION

The damage may not be as spectacular, nor the destruction as sudden . . . but . . . the hundreds of tons of water used in your plant may be as crippling to vital production as the explosion of a 4000 pound bomb.

Water can play havoc with production schedules, waste precious fuel and ruin irreplaceable power plant equipment . . . unless it is conditioned against scale, corrosion, embrittlement, oil, etc.

Power plants . . . so essential to the war effort . . . are invited to make full use of Infilco's 49 years' experience in water conditioning. Call on our Chemical Engineering Staff for any problem involving boiler and evaporator feedwater treatment, condensate oil removal, steam purification or cooling water conditioning.

INFILCO
INCORPORATED

325 W. 25TH PLACE, CHICAGO, ILL.
Formerly INTERNATIONAL FILTER CO.

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

INFILCO

Oil-drenched and salt-encrusted, PYRANOL TRANSFORMERS COME THROUGH UNHARMED

Three Pyranol* transformers were in operation on a large tanker when it was torpedoed off the Atlantic coast. For days they lay submerged in oil and salt water, until what was left of the tanker was salvaged. When the ship finally reached dry dock, the transformers were tested and found to be in as good working condition as the day they were installed.

IT'S HARD to find an application where Pyranol transformers won't fill the bill. The high dielectric strength which they have in common with other liquid-filled transformers makes it easy for them to withstand the effects of lightning and of voltage surges from switching operations.

Install Pyranol Transformers Right Where You Need Them

Location doesn't matter; you can install Pyranol transformers underground, on an overhead platform, on the roof, on the factory floor, indoors or outdoors—or install them indoors this year and move them outdoors next year if your needs change. The pressure-tight tank protects vital parts from the effects of dust, dirt, and atmospheric moisture—as well as from oil and salt water.

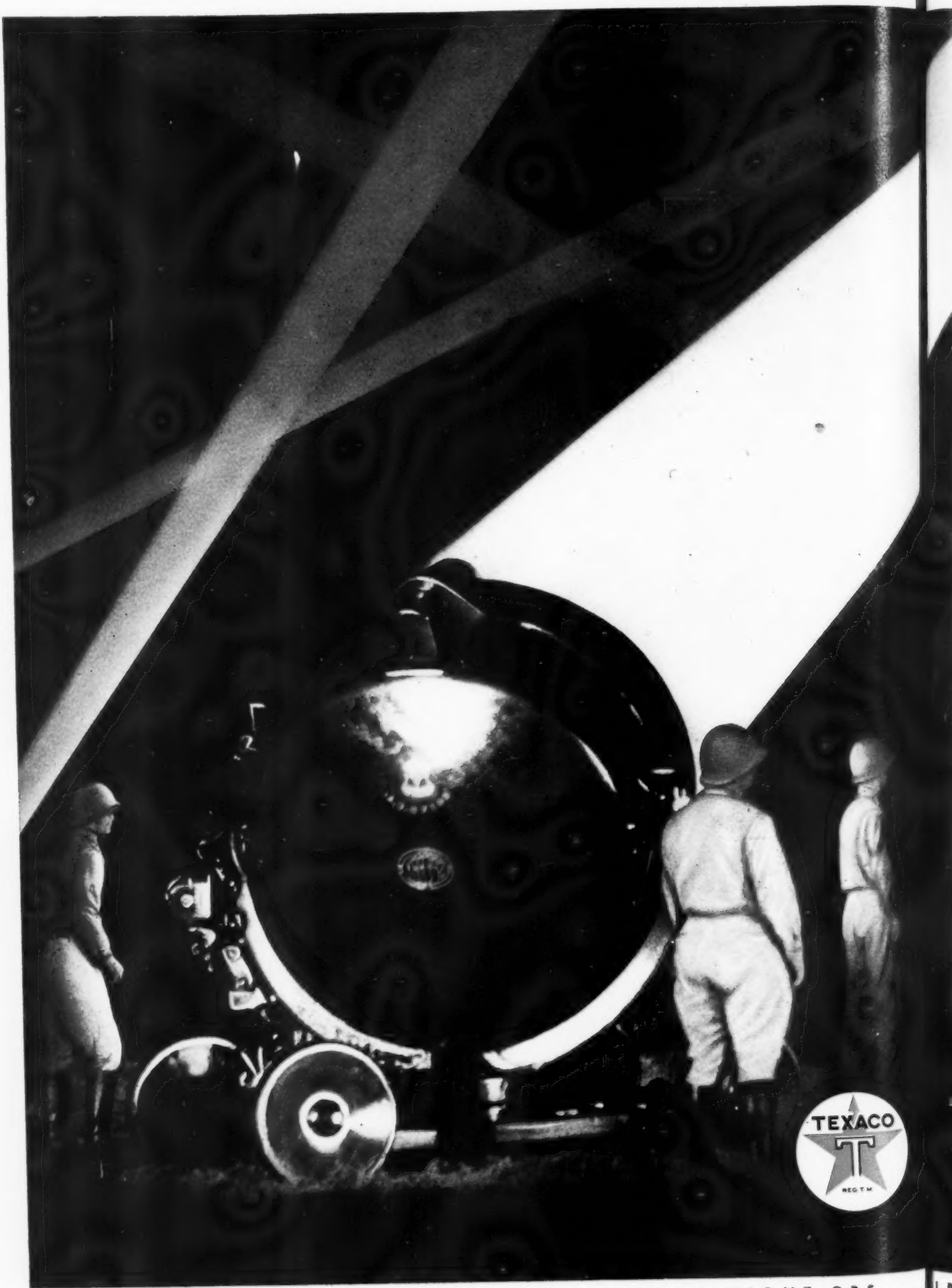
Maintenance Cost Is Low

Pyranol, the synthetic, noninflammable liquid with which these transformers are filled, is nonsludging—maintenance is negligible. Tests made recently show that the Pyranol in the first transformers of this type, installed more than ten years ago, is still in its original condition.

For further information about Pyranol transformers, call your G-E representative today. He'll be glad to help you. *General Electric Company, Schenectady, New York.*

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC



TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

EYES OF OUR ARMY

...Diesel-powered!

SPOTTING enemy aircraft miles up requires searchlights of 800,000,000 candlepower, many of which are Diesel powered.

Thousands of Diesels, producing power not only for our Armed Forces, but for war plants, lighting plants, pumping stations, transportation, etc., are maintained at peak efficiency, lubricated with Texaco.

Texaco Algol or *Ursa Oils* keep Diesel engines *clean,* free from gum, sludge and carbon-forming deposits. Their use assures long life of bearings and liners, free rings, compression-tight piston seal, full power, and *fuel economy.*

Because of operators' success with it—

More stationary Diesel horsepower in the United States is lubricated with Texaco than with any other brand.

Outstanding performance has made Texaco *first* in the stationary Diesel field. It also leads in the fields listed in the panel.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

TEXACO Lubricants and Fuels

FOR ALL DIESEL ENGINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

MORE DRIVES *Using Chains*

When production requirements were a fraction of output capacity . . . when top machine efficiency was not vital . . . and lost down time could be handled by idle standby equipment and did not mean a possible loss of American fighting men's lives . . . then inefficient drives got by!

Now, planes and tanks, ships and guns are needed fast . . . parts production is vital . . . every K.W. of power . . . every R.P.M. . . . has an important job to do.

To meet today's production demands, more and more manufacturers are modernizing machine tool drives with Morse Chains, and specifying Morse Chain Drives on new machines. Many have found production increased as high as 25%, servicing time reduced, slipping and frictional contact losses eliminated and uniform production maintained.

Morse Engineers will help you modernize your drives for greater production.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

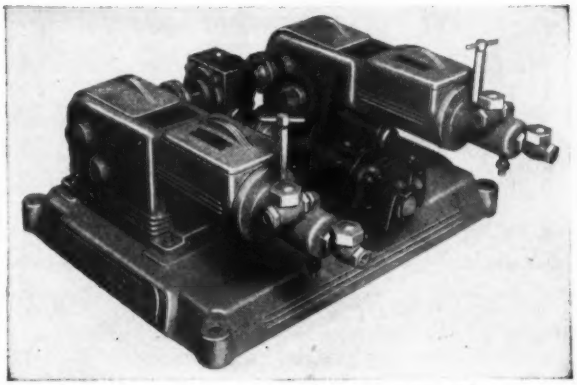
%PROPORTIONEERS%
SPECIALIZED ENGINEERING ON PROPORTIONING PROBLEMS

FOR INSTANCE . . .

CASE HISTORY NO. 8. At a certain naval base, internal boiler treatment to each of four boilers was necessary — and continual operation imperative. A %PROPORTIONEERS% Quadruplex Adjust-O-Feeder won instant approval because each pump is a complete unit—to replace in any assembly you need only remove four bolts, release coupling, and slide spare pump into place. Other features include:

1. Straight through drive shaft design permits mounting up to 8 units, operated from a single central motor (duplex design illustrated).

2. Available in either plunger or diaphragm types. Plunger units (0 to 10 g.p.h.) with Bakelite or plastic cylinders (0 to 200 lbs.), with stainless or iron (0 to 1000 lbs.) are equipped with %PROPORTIONEERS% fluid sealed stuffing gland for hard-to-handle and corrosive fluids; and built-in ball type checks. Diaphragm units (0 to 7½ g.p.h.; 0 to 100 lbs.) are available with neoprene pre-formed reinforced diaphragms—no stuffing gland—plastic diaphragm heads—built-in suction and discharge valves with sight feed domes.



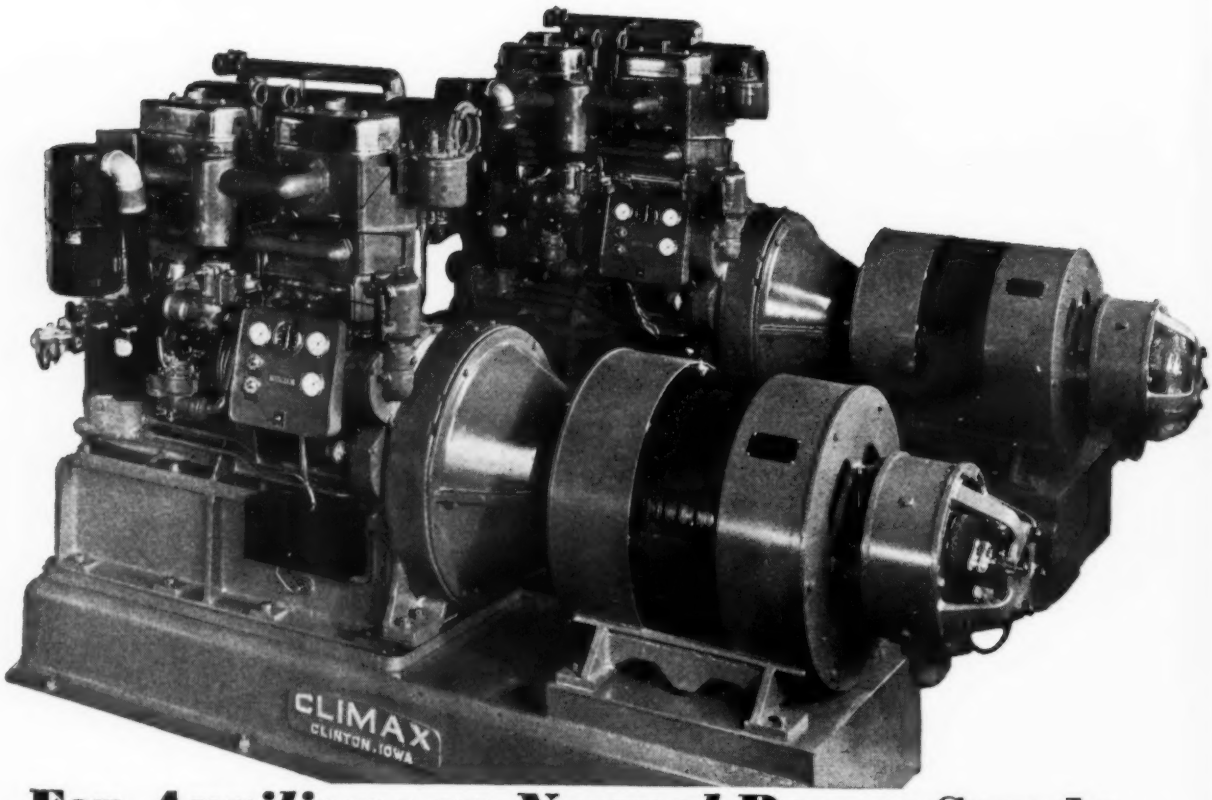
Duplex Midget Adjust-O-Feeder Proportioning Pump of Plunger Type. Available with from 1 to 8 units driven from a single central motor. See Feature No. 1, above.

3. Micrometer stroke adjustment through neutralizing eccentrics.

4. Fully enclosed frame presents pleasing appearance, protects moving parts, and eliminates necessity of guards.

Complete engineering details forwarded upon receipt of full information about your problem. Address—

%PROPORTIONEERS, INC.%
16 CODDING STREET, PROVIDENCE, R. I.



For *Auxiliary* or *Normal* Power Supply...

Specify Climax Electric Generating Sets

The Typical Generating Set

consists of a 4-cycle internal combustion engine of 1 to 12 cylinders — burning any one of a variety of fuels. The engine is direct connected to an a-c. or d-c. generator of required voltage and speed. The complete unit is mounted on a cast iron or welded steel sub-base. For portable service it may be enclosed and mounted on wheels. For stationary use, sub-base may be bolted to a concrete foundation.

Climax Generating Sets are available in over 100 sizes and types from 300 watts to 312 kv-a. For details write to the address below—Dept. X.

Climax
Engineering Company
GENERAL OFFICES & FACTORY:
CLINTON, IOWA
REGIONAL OFFICE: DALLAS, TEXAS

for Auxiliary Power

Climax Generating Sets:

1—Lengthen the life of other types of generating equipment by preventing overloading during peak periods.

2—Make possible higher loading without a comparable increase in equipment costs.

3—Provide dependable low cost protection for valuable equipment which must be continuously operated.

4—Effect savings in power bills, for industrial plants, by reducing consumption of purchased power during peak demand periods.

5—Produce electric power at low cost through use of local fuels, particularly where natural gas is available.

for Normal Power

Climax Generating Sets:

1—Put you "on your own" at profit.

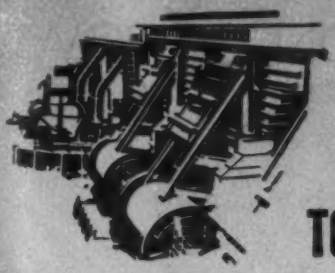
2—Meet load variations economically through synchronized and parallel operation of generating sets.

3—Are "tailored" to individual requirements and absorb overload without speed reduction. Thus making possible uniform output voltages.

4—Provide unfailing operation through the ability to burn different fuels—natural gas, sewage gas, butane, gasoline, etc. Should one supply fail, another fuel can be used.

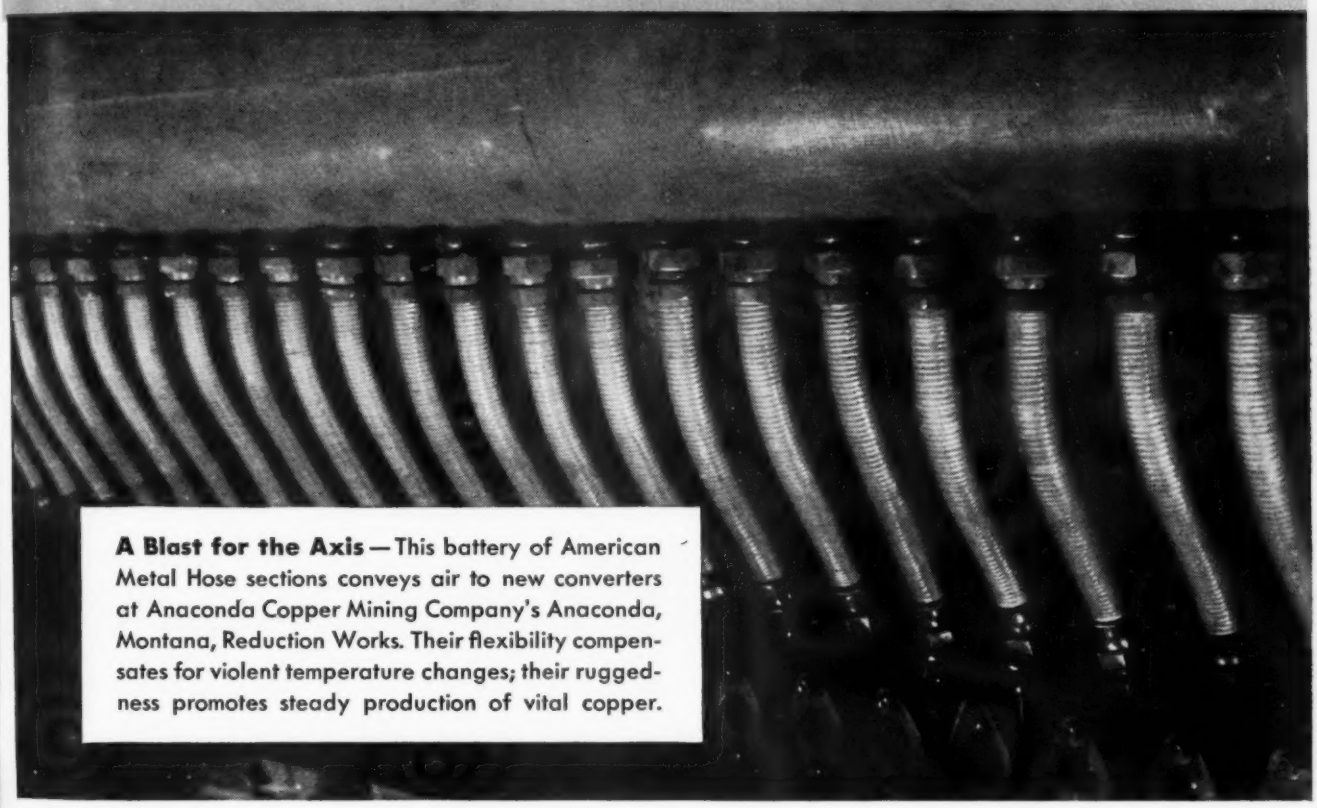
5—Using local fuels, such as natural gas, generate electricity at low cost.

A Count of Climax Installations for power service includes practically every type of commercial, industrial and federal project. Included in the list are generating sets for public, office and store buildings, banks, warehouses, packing and processing plants, factories, hospitals, churches, terminals for airways, railroads, bus stations, jails, sewage plants, radio stations, theatres, camps, armories, arsenals, etc.



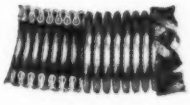
Hose that conveys cold air under 15 lbs. pressure

TO FURNACES HOLDING TONS OF MOLTEN COPPER



A Blast for the Axis—This battery of American Metal Hose sections conveys air to new converters at Anaconda Copper Mining Company's Anaconda, Montana, Reduction Works. Their flexibility compensates for violent temperature changes; their ruggedness promotes steady production of vital copper.

One of the most attractive features of flexible metal hose and tubing is its seemingly endless range of application. Using virtually any workable metal, we can build flexible hose or tubing for almost any purpose—from a simple spout to a high pressure seamless hydraulic line that can be flexed millions of times without breaking—a line that will give you the flexibility of garden hose, the dependability of metal and the *strength of rigid pipe!*



American Seamless — corrugated from seamless rigid tubing . . . no welds, laps or joints . . . made in several alloys.

Whether you need a flexible connector for misaligned or moving parts, for isolating vibration, for conveying air, water, oil, steam or fuel,

American Interlocked —wound of strip metal, joints packed; the toughest type of extremely flexible metal hose.

you'll likely find we have a type of flexible metal hose or tubing that will do the job more capably.

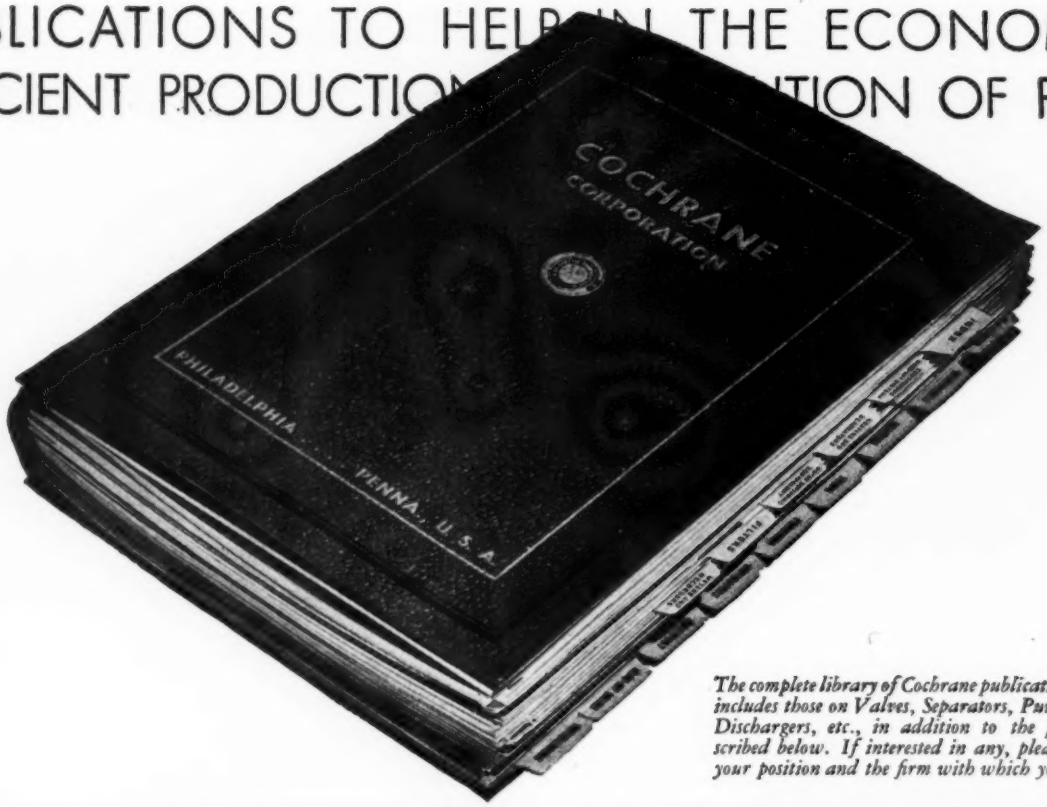
43197

ANACONDA

American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

PUBLICATIONS TO HELP IN THE ECONOMICAL EFFICIENT PRODUCTION ... TION OF POWER



The complete library of Cochrane publications shown above includes those on Valves, Separators, Purifiers, Drainers, Dischargers, etc., in addition to the publications described below. If interested in any, please write, giving your position and the firm with which you are connected.

WATER SOFTENING

Publication 3000: Cochrane HOT PROCESS SOFTENERS

A treatise on the subject of the treatment of boiler feedwater, with particular reference to the different methods of softening, and specifically that of hot process softening. Details of design and apparatus, with hook-ups and descriptions of heaters, proportioners, etc., are included. A special section on the chemistry of feedwater treatment with formulae and molecular and equivalent weights is a valuable part of this publication. 48 pages, 3 colors, 8½" x 11".

Publication 2860: Cochrane ZEOLITE WATER SOFTENERS

A complete discussion of the subject of cold softening of water for industrial uses, such as boiler feed, laundries, textiles, the canning industry, institutions, hospitals, etc., with a description of the Zeolite method of softening, details of the apparatus required, how to compute capacity needed, with diagrams of types of units and photographs of typical installations. Complete tables of weights, capacities and dimensions are included. 20 pages, 2 colors, 8½" x 11".

CONTINUOUS BLOW-OFF SYSTEMS

Publication 2770: Cochrane CONTINUOUS BLOW-OFF SYSTEMS

An interesting and informative discussion of the advantages of continuous boiler blow-down as compared with intermittent blow-down. Savings are such that cost of equipment can be returned in a year's time, in most cases. The great saving is in heat recovery and the big advantage is in the uniformity of boiler water concentration avoiding priming and foaming or carry-over. 12 pages, 2 colors, 8½" x 11".

DEAERATION, HEATING, HOT WATER STORAGE

Publication 3005: Cochrane DEAERATORS

A completely illustrated booklet on the subject of conditioning feedwater to prevent corrosion of piping, boiler tubes, economizers, etc., with especial reference to heating, deaeration and degasifying. Different types of deaerators and deaerating heaters are illustrated and described together with a discussion of the advantages of the parallel down-flow principle. Fully illustrated with diagrams and photographs. 36 pages, 3 colors, 8½" x 11".

FLOW METERS

Publication 3010: FLOW METERS by Cochrane

This large fully illustrated publication covers in detail the measurement of fluid flow, liquid level, temperature, pressure, etc. There is much basic material on instrumentation as well as specific data on particular types and models. Of great value to all operators and executives. 56 pages, 3 colors, 8½" x 11".

FILTERS

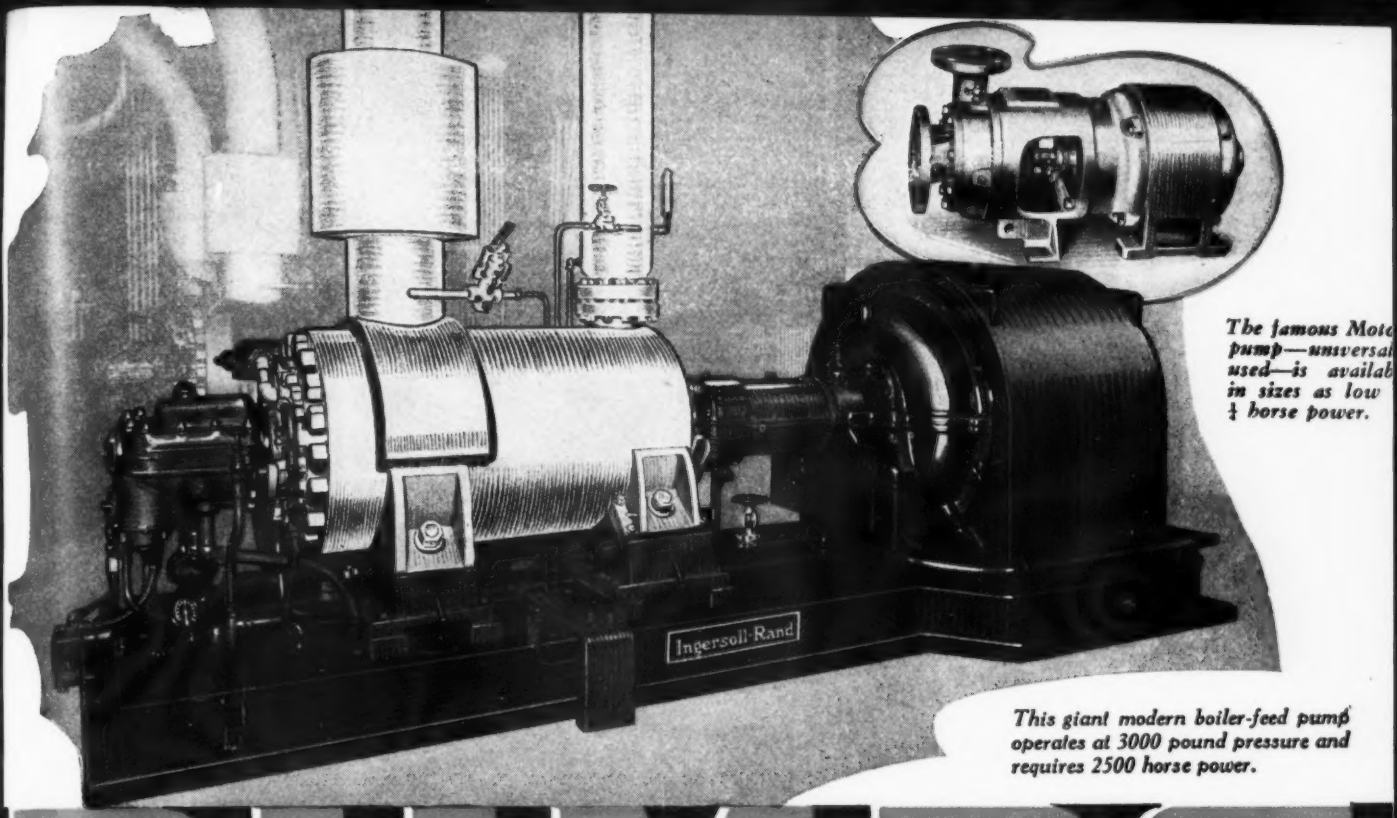
Publication 2760: Cochrane PRESSURE FILTERS

A discussion of the clarification of water by filtration, with complete descriptions of different types of filters, including capacity and dimension tables. 16 pages, 2 colors, 8½" x 11".

COCHRANE

WATER SOFTENERS • DEAERATING HEATERS • FILTERS • BLOW-DOWN EQUIPMENT • VALVES • FLOW METERS

Write to **PUBLICATION DEPT. COCHRANE CORPORATION • 3106 N. 17th ST., PHILADELPHIA, PA.**



The famous Moto pump—universal used—is availab in sizes as low ¼ horse power.

This giant modern boiler-feed pump operates at 3000 pound pressure and requires 2500 horse power.

PUMPS

APPLIED BY INGERSOLL-RAND

★ **MORE SEA POWER . . .** battleships, cruisers, destroyers, carriers, mine layers, cargo and troopships, tankers and tugs slide off the ways . . . each depending upon Centrifugal Pumps, scientifically applied.

★ **MORE AMMUNITION . . .** more cooling waters for protection . . . more wash waters for processing . . . more liquids for refrigeration . . . with Centrifugal Pumps, scientifically applied.

★ **MORE METALS AND COAL . . .** from the bowels of the earth is lifted the mine waters . . . the water for smelting and refining . . . impelled by Centrifugal Pumps, scientifically applied.

★ **MORE MACHINE TOOLS . . .** the flow of lubricants and coolants is assured by Centrifugal Pumps, scientifically applied.

★ **MORE OIL AND GASOLINE . . .** crude from the well courses to and through the refinery, proceeding to destination, via pipe lines, into and out of tankers, tank cars and trucks . . . all by Centrifugal Pumps . . . scientifically applied.

★ **MORE POWER . . .** mammoth steam plants of utilities and industries step up output . . . pumps for boiler feeding, for condensers, for plant services go into action . . . higher temperatures today, too . . . higher pressures (to 3,000 lb.) . . . pumps requiring 2,500 h.p. . . . Centrifugal Pumps, scientifically applied.

★ **MORE FOODS . . .** more water for cleaning, for cooling, for processing . . . more milk, more syrups, more oils, more soups . . . more and more liquids on the move, impelled by Centrifugal Pumps, scientifically applied.

Pumps . . . more pumps . . . always better pumps built to resist corrosion, to obviate severe shock, to meet new demands in pressures and temperatures, to solve countless problems in numberless applications . . . simple applications . . . complex applications . . . light jobs, heavy jobs. *Thus "Applied by Ingersoll-Rand" may well be interpreted into "Keep 'em Flowing to Victory."*

COMPRESSORS
TURBO BLOWERS
CENTRIFUGAL PUMPS
OIL AND GAS ENGINES
ROCK DRILLS
AIR TOOLS
CONDENSERS

10-19

Ingersoll-Rand

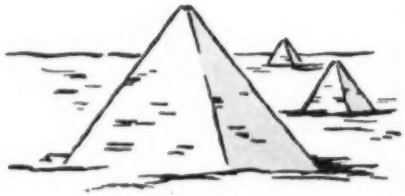
11 BROADWAY, NEW YORK, N. Y.

IF IT'S SIZE THAT COUNTS

Then make it BIG!

To us, size is simply the result of manufacturing a product to fit a specific need — to do the job for which it is intended. Whether it's the biggest in Goose Creek or China — it really doesn't matter. The important thing is — **RESULTS.**

If size really counts then Graver can point to an installation which we believe, tops all previous records for Hot Process Water Softeners with built-in Deaeration equipment.



This plant, which is at present operating at (CENSORED)*, has a capacity for delivering 120,000 gallons of softened deaerated water per hour — 2,000 gallons per minute as the clock ticks. It has a storage capacity for 20,000 gallons of treated and deaerated water, and 3,000 gallons of deaerated condensate. Separate lime and soda chemical tanks are a part of the equipment and proportioning is automatically controlled by a Graver Remote Control Proportioner. Raw water heaters are of the spray type and there are eight pressure filters, each one eleven feet in diameter.

And still, this isn't our largest. Right now we are building a Hot Process Water Softener that will have a capacity of 170,000 gallons per hour.

But, again we say, it isn't just the size that counts. It's the engineering skill, the manufacturing ability, and the more than thirty years of experience in this work that combine to make Graver Water Conditioning Equipment outstanding in results — regardless of size.

If you have a problem involving equipment, large or small, for the treatment of a water supply — Graver engineers are ready to work with you and without obligation.

**War Plant — Name and Location Cannot Be Divulged*

WATER SOFTENERS
•
FILTRATION SYSTEMS
•
CLARIFIERS
•
SEWAGE EQUIPMENT
•
STEEL STORAGE TANKS
•
VAPOR CONSERVATION SYSTEMS
•
WELDED CONSTRUCTION
•
STRESS RELIEVING
•
X-RAYING
•
FABRICATED STEEL AND NON-CORROSIVE PLATE

GRAVER

GRAVER TANK & MFG. CO., INC.

NEW YORK
CATASAUQUA, PA.

4809-25 TOD AVE.
EAST CHICAGO, IND.
CABLE ADDRESS — GRATANK

CHICAGO
TULSA

43-11-W

THE M. W. KELLOGG COMPANY

Fabricators and Erectors

of

COMPLETE PIPING SYSTEMS

for

HIGH PRESSURE — HIGH TEMPERATURE
PUBLIC UTILITY and MARINE POWER PLANTS

* * *

PROCESS PIPING FOR INDUSTRY

* * *

Heat Transfer Equipment for Industrial and Marine Power Plants

KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUHK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, N. Y.
REPRESENTATIVES
LOS ANGELES: 609 SOUTH GRAND — TULSA: PHILTOWER BLDG.

FLASH and
OIL IS AMMUNITION
USE IT WISELY !
DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.
INDUSTRIAL
TYCOL
OILS-GREASES
SCIENTIFICALLY ENGINEERED
FOR EVERY INDUSTRIAL USE
TYCOL

FIRE

This is #2 of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

T I D E W A T E R L U B R I C A N I A

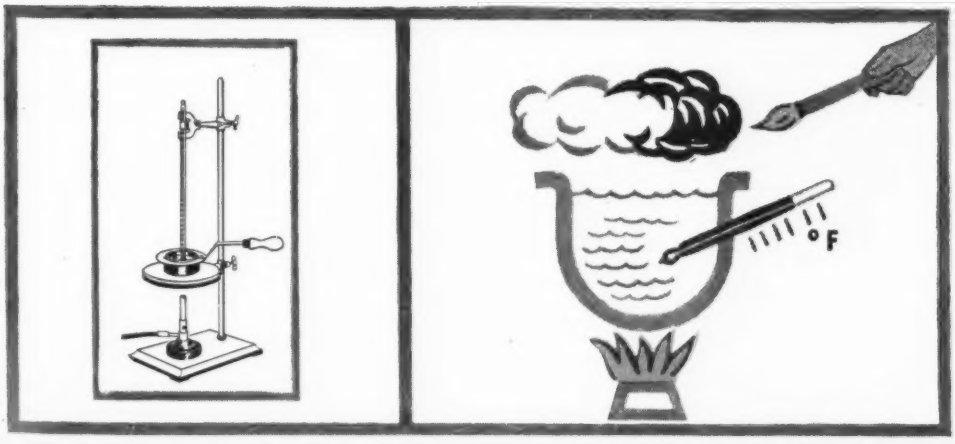
DEFINITION: That temperature at which a lubricating oil will first give off sufficient vapors to ignite when approached by a small flame or spark is termed the flash point—the lowest temperature at which when ignited, the oil continues to burn is called the fire point.

TEST: The flash point and the fire point of lubricating oil are usually determined by means of the Cleveland Open Cut Tester by following a definitely prescribed procedure. The oil under test is heated and a small pilot flame is moved over the cup with every 5°F rise in oil temperature. The first time a flash occurs on the surface of the oil, the temperature of the oil is recorded as the flash point. If the oil is heated still further and tested with the pilot flame, it will commence to burn with a continuous flame. When this occurs the oil temperature is recorded as the fire point.

For most purposes knowledge of the Flash Point alone is sufficient. It indicates the ordinary fire hazard in handling petroleum fuels and similar volatile products. With lubricating oils, Flash Points sufficiently high to avoid undue evaporation losses in service are definitely required.

The following illustrates examples of flash points of typical petroleum products, fire points being somewhat higher:

Gasoline .....below 0°F	Kerosene .....115-150°F
Cleaning Naptha ....110-115°F	Light Machine Oil....325-400°F
Heavy Cylinder Oil..525-625°F	



Tycol lubricants are subject to rigid flash point control during manufacture. Uniformly correct flash points, insuring undiluted products in every grade, are one of many Tycol characteristics contributing to high quality.

TIDE WATER ASSOCIATED OIL COMPANY

Eastern Division: 17 Battery Place, New York • *Principal Branch Offices:* Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

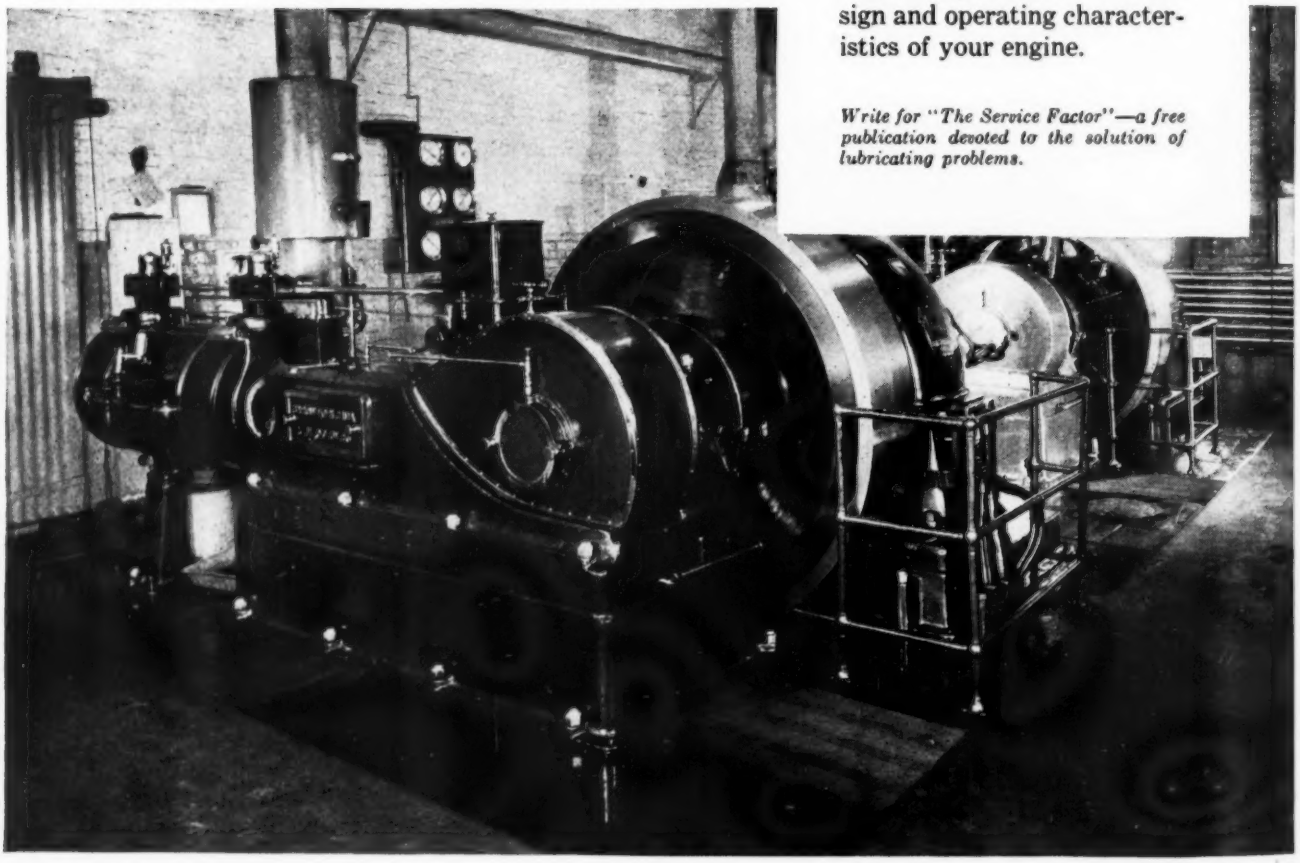
MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

INDUSTRIAL LUBRICANTS

FIRE POWER needs manpower — and *horsepower*. To maintain full designed *STEAM* plant horsepower use . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils provide *correct* power house lubrication under any combination of steam conditions and steam recovery requirements. Sinclair provides oils exactly suited to the design and operating characteristics of your engine.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

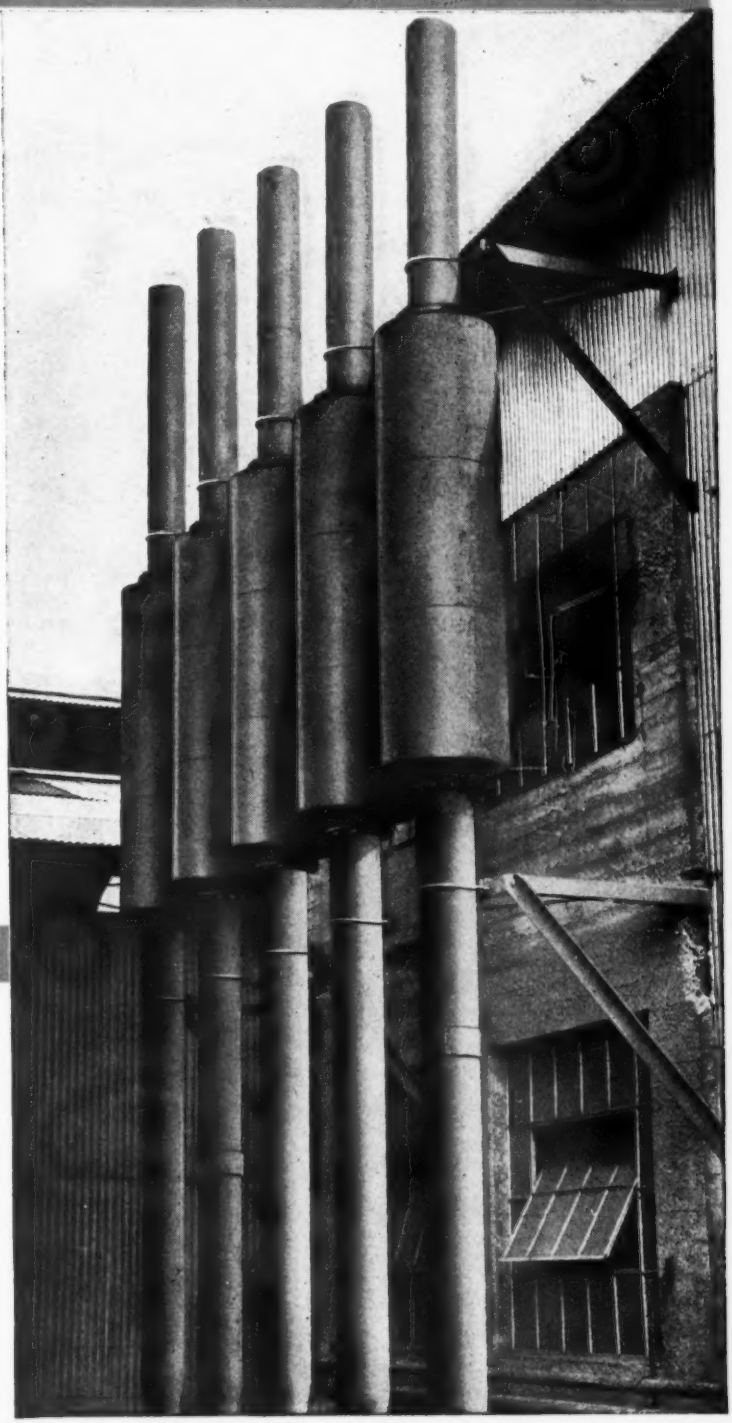
2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

A CORPS OF EXPERTS

AT YOUR SERVICE
(NO PRIORITY NEEDED)

Maxim Engineers are experts not only in the designing and building of silencing equipment but also in the solution of practical installation problems that occur in the field. Right now Maxim equipment is available only on high priority ratings, but the advice of the Maxim engineering department is yours for the asking . . . whether or not you have or can buy Maxim Silencers. If you are troubled with poor engine efficiency which you feel is due to any factor in the installation of your present exhaust or intake lines (with or without silencers), we think that we can probably help you.

Simply write to Maxim giving complete engine specifications, a sketch of your present hook-up, describing existing exhaust and intake piping arrangement in detail, and notes on what your difficulty seems to be.



WASTE HEAT CONSERVATION

IMPORTANT Maxim's new Waste Heat Units make waste exhaust heat produce steam or hot water while at the same time providing efficient silencing for engine exhaust. This important development is discussed in Maxim Waste Heat Bulletins WH-100 and WH-103, available on request. The Maxim Silencer Company, 92 Homestead Ave., Hartford, Conn.

MAXIM

WARTIME ENGINEERING SERVICE

On Guard

WHERE BOILER HORSEPOWER MUST NOT FALTER!

"F&E" DESIGNED FEATURES—

1. Electro-Hydraulic Drive
Pioneered by "F & E". An achievement in simplicity . . . has ONLY 5 MOVING PARTS that are sealed and operates in a bath of oil. Amply protected against damage should foreign matter be fed in with coal. One motor drives the entire mechanism.

2. "F&E" Interval Timer Governor (patented)
Permits accurate adjustment of coal feeding rates, provides desirable Full-Speed, Full-Stroke Ram Action at all feeding rates.

3. Retort Sliding Bottom
Assures equal distribution of coal over entire boiler area . . . a necessity for efficient operation.

4. Exterior Fuel Bed Regulator
Permits adjustment of burning fuel bed without reducing coal feed in event of change in grade of fuel.

5. High Efficiency Tuyeres
Designed by "F & E" to produce perfect combustion. Made of heavy, heat-resisting metal.

"F&E" STOKERS ARE DESIGNED FOR DEPENDABILITY...ENGINEERED FOR EFFICIENT OPERATION AND LOW MAINTENANCE

In fifteen years "F & E" Underfeed Stokers have acquired a reputation for dependability that was brought about by the "F & E" policy of producing a line of stokers engineered to make automatic coal burning an asset to power plants.

Every detail of "F & E" Underfeed Stokers is, in reality, an engineering advancement designed to do a particular part of the coal-burning job well. In combination they produce high efficiency, economical operation and low maintenance . . . results that are demanded by all power engineers.

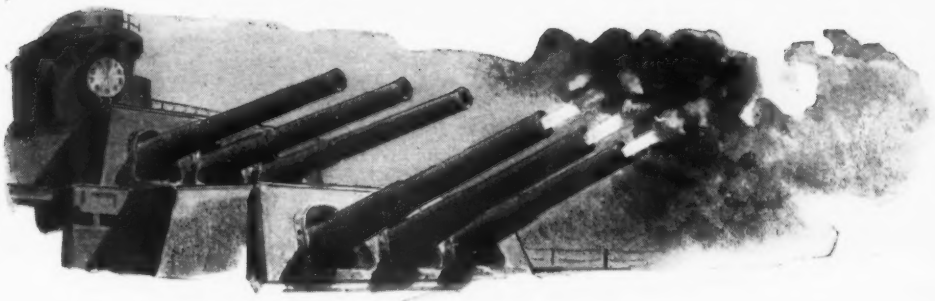
Hundreds of "F & E" installations throughout the coal-burning areas of the United States are, today, producing a large share of the horsepower that is turning the wheels of war production and civilian industry . . . furnishing the heat that will preserve the health of the occupants of housing projects, hotels and apartments.

THE FLYNN & EMRICH COMPANY
ESTABLISHED 1842 — BALTIMORE, MARYLAND
Representatives in Principal Cities

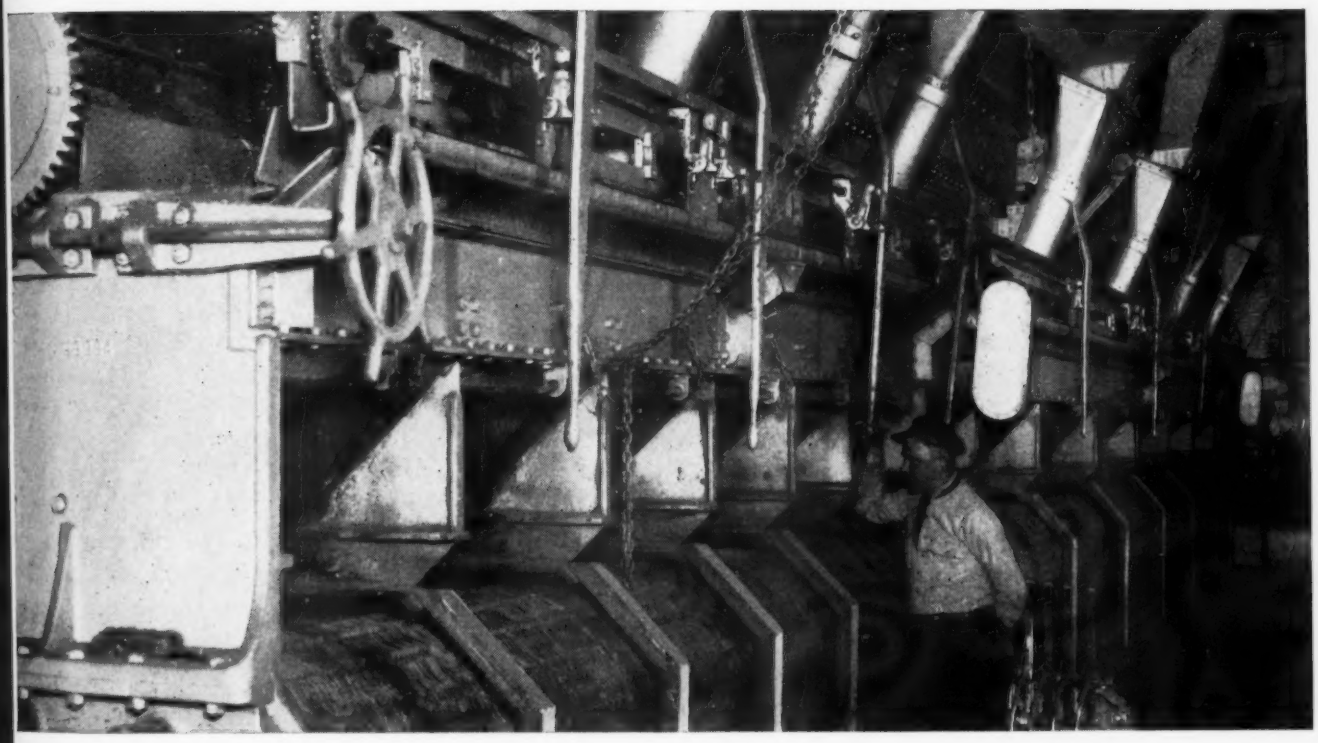
"F&E" Stokers are 'on the job' successfully burning F&E **the lowest as well as the highest grades of coal**

UNDERFEED STOKERS

BITUMINOUS AND ANTHRACITE TYPES—ELECTRO-HYDRAULIC AND STEAM DRIVE
FOR HEATING OR POWER BOILERS REQUIRING 1,000 TO 40,000 LBS. OF STEAM PER HOUR.



There is another kind of battery that must be kept on the "firing line"



BATTERIES of boilers on the industrial front are important production equipment.

They must be kept on the "firing line" with the least possible time out for furnace repairs.

And here is another case where "Carbofrax"—the Carborundum Brand Silicon Carbide Refractory, becomes a "Weapon for Production." Installed in clinker zone of boiler settings, "Carbofrax" brick eliminate frequent furnace outages for lining replacement, increase steam production and lower maintenance costs.

"Carbofrax" brick insure these advantages because of their extremely high refractoriness—their resistance to spalling and cracking—their resistance to clinker adhesion with consequent improvement in combustion conditions. With "Carbofrax" you can keep your boiler furnaces on the "firing lines."

Current production of our super refractories is wholly for war industry plants

REFRACTORY CARBORUNDUM PRODUCTS

Refractory Division, **THE CARBORUNDUM COMPANY,** *Perth Amboy, N. J.*

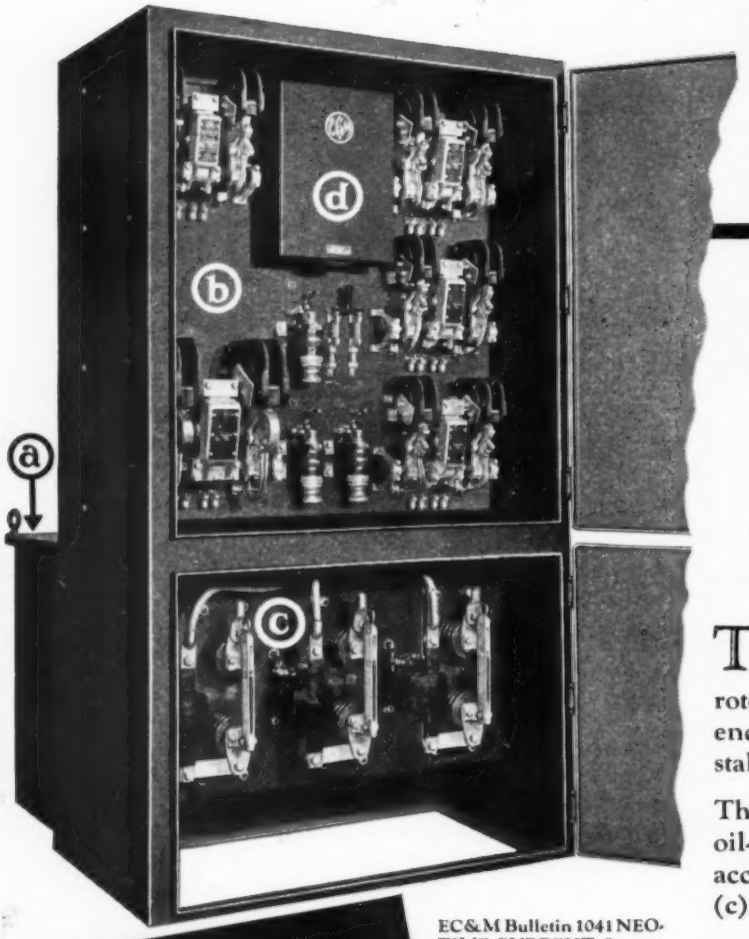
REG. U. S. PAT. OFF.

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum and Carbofrax are registered trade-marks of and indicate manufacture by The Carborundum Company)

EC&M Steel-Clad MOTOR CONTROL

FOR 2300 V. wound-rotor motors



EC&M Bulletin 1041 NEO-TIME-CURRENT Starter.

—DRIVING CRUSHERS BELT CONVEYORS, ETC.

THIS is the EC&M Unit-type Starter of Steel-clad design for high voltage wound-rotor motors. It is completely wired . . . totally enclosed . . . shock-proof, hence quickly installed and *safe*.

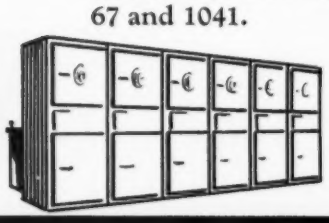
The EC&M 2300 volt Magnetic Contactor is oil-immersed in rear tank (a) with secondary acceleration panel (b) and disconnect switches (c) mounted in front compartment.

Acceleration is by the EC&M NEO-TIME-CURRENT (d) method . . . a unique system for bringing a.c. wound-rotor motors up to speed automatically. It accelerates motors quickly on light loads . . . lengthens time *automatically* on heavy loads . . . yet forces motors to maximum torque when needed.

For complete information on these EC&M Magnetic Starters for a.c. wound-rotor motors, ask for Booklets 67 and 1041.

Outstanding FEATURES OF DESIGN

1. Safety interlocks on all starter units.
2. Self-contained bus between units when arranged for group installation.
3. Semi - dust - tite enclosure (NEMA Type 1A).
4. Utmost accessibility through front doors and rear plates.
5. Removable plate on end unit for bus extension when adding units for a group installation.



Where more than one motor drive is involved, these motor control units can be centralized at a convenient location.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND ★ **OHIO**

91,000,000 POUNDS of STEAM

is a lot of steam . . . . . but

EDGE MOOR BOILERS *generate this volume*

EVERY HOUR *. . . . to help the war effort*

in these basic key industries . . . .

INDUSTRY	HORSEPOWER (Normal Rating)
Cement	157,227
Chemical	37,078
Food	57,287
Iron & Steel	34,075
Leather	19,549
Machine Tool	30,784
Mining & Smelting	34,144
Paper & Pulp	97,020
Petroleum	35,055
Public Utilities	438,257
Railroads	19,134
Rubber	11,212
Textiles	105,219

At an average rating of 250%, this is equivalent to 2,700,000 H.P.

The above does not include Navy Yards, Municipalities, Institutions, Arsenals and unclassified industries or foreign installations which generate additional thousands of horsepower with Edge Moor Boilers.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N.Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

IN CANADA — UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

BEARINGS OR BULLETS

Today, more than ever before, man-hours are the dominating factor whether in the manufacture of bearings or bullets. Therefore, by making bearings last longer more man-hours can be applied to production of bullets—and that's important these days.

BALL BEARING LUBRIPLATE will, by virtue of its outstanding lubrication and protection features, make your ball and roller bearings last longer. LUBRIPLATE is different from any lubricant you ever used. It possesses characteristics not to be found in ordinary lubricants.

Just think what it would mean to you if you could double or treble the life of your anti-friction bearings—reduce replacement bearing and labor costs—avoid unnecessary production interruptions. That is exactly what scores of manufacturers are accomplishing with BALL BEARING LUBRIPLATE.

Your investment in ball and roller bearings is certainly great enough to warrant your investigation of BALL BEARING LUBRIPLATE. Write today for your free copy of "THE LUBRIPLATE FILM" No. 1-43 containing valuable information on the lubrication and care of ball and roller bearings.

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING COMPANY
NEWARK, N. J. **SINCE 1870** TOLEDO, O.
WRITE FOR THE NAME OF THE DEALER NEAR YOU

AN IMPORTANT *Minus* IN THE BOILER ROOM···

A VALUABLE *Plus* IN ANY PLANT···

···Less Fuel Goes In!

··MORE STEAM COMES OUT!

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

FOR PLANTS AS SMALL AS 60 H.P.

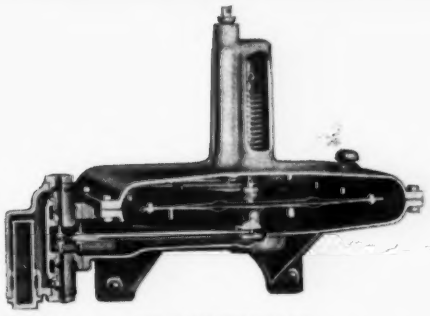
or Large as you Please

• Your present boiler is no doubt doing the best it can for you under existing conditions. Yet, there's more ability in that boiler than you think. The answer lies in CASH STANDARD Automatic Control Systems. Through this modern control of air flow — of fuel feed — of draft, your boiler will yield needed extra steaming capacity and boost operating efficiency as well.

The reason is simply in the fact that there is no wasted fuel — you burn the fuel economically. All of the fuel produces for you. Today is a most important time to make your boiler "stretch" in capacity so that your fuel supply lasts longer. An added saving is that you conserve manpower by cutting attendance time.

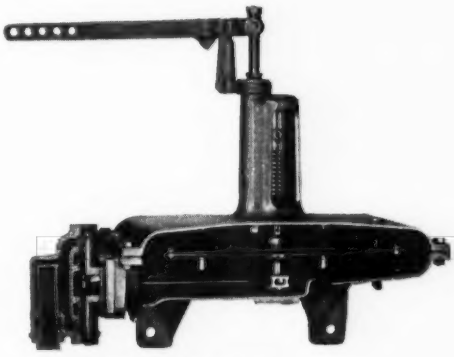
You can make a complete CASH STANDARD Automatic Combustion Control System from the units pictured and described. Through variations of these units all boiler requirements can be supplied.

Write for Bulletin No. 300 for details on this modern steam plant economy.



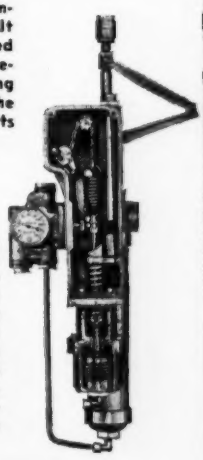
FURNACE DRAFT CONTROLLER

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



AIR FLOW CONTROLLER

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS .. VALVES

Enlarged reproduction free on request

Servant of Freedom

Mighty servant of all America is the Construction Industry. Its strength is the strength of our great quarries, mines and forests. Its driving power comes from our extensive oil wells and factories . . . and from the minds of men who dream of making an ever better world.

Now during war, Construction marches only against the enemy . . . but with Victory, Construction will again bring progress in its train.

Already the Construction Industry has brought us vast networks of highways, bridges and airports —to help free men from barriers of distance, time and transportation costs . . . massive dams are making low-cost electricity available to more and more millions, lifting old burdens . . . vast aquaducts and sanitation systems are contributing to our people's health.

With the return of peace, Construction will bring in its train ever new and greater contributions toward the better life for all.

★ ★ ★

Wickwire Rope is proud of the privilege of helping the Construction Industry in its engineering accomplishments . . . in quarries, on highways, in the building of dams, bridges, and structures of all kinds.

A CHALLENGE

The present shortage of steel, and of wire rope, challenges each member of the Construction Industry to make each length of wire rope now in service last longer than ever before. Every man who uses or handles wire rope can help.

We will be glad to furnish free copies of the helpful book "Know Your Ropes," which pictures the right and wrong ways to use wire rope. TAKE UP THE CHALLENGE—WRITE FOR YOUR COPY—AND MAKE SURE ANY NEW MEN KNOW THE *RIGHT* WAYS. . . . Address Wickwire Spencer Steel Company, 500 Fifth Ave., New York, N. Y.

COPYRIGHT 1943, WICKWIRE SPENCER STEEL CO.

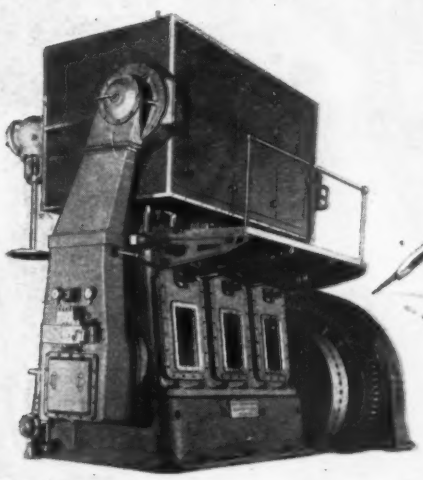
WICKWIRE
WICKWIRE SPENCER STEEL COMPANY

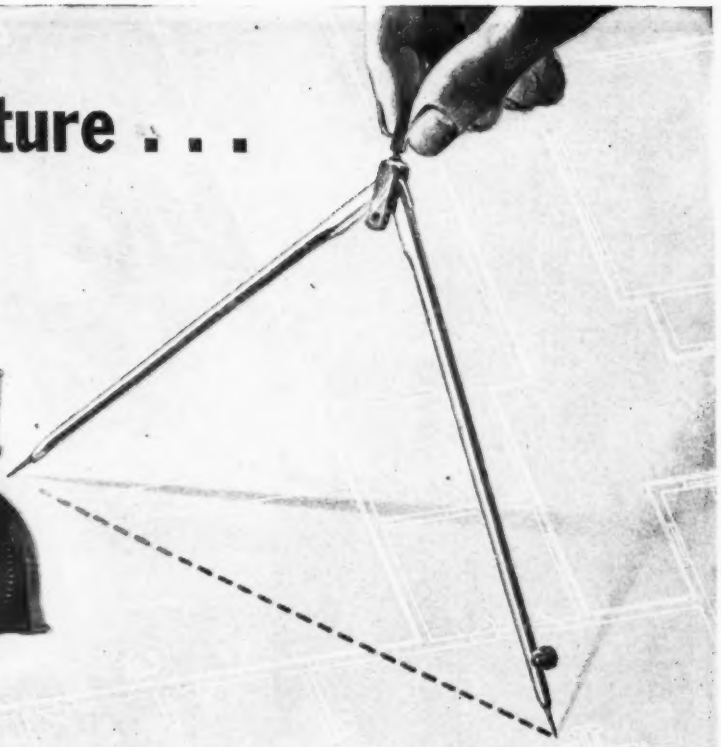
WICKWIRE ROPE

Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City

WISSCO PRODUCT

Plan for the Future . . .





. . . To Generate Your Own Power

with SKINNER "Universal Unaflow" STEAM ENGINES

Proudly we fly the Army—Navy "E" Flag, awarded for excellence in production

INDUSTRIAL America is already looking forward to the day when our gigantic wartime plants will be restored to a peacetime basis. When that day arrives, vital materials now required by our armed forces will again be available for the production of consumer goods. Healthy competition in business will be resumed, and the manufacturer whose production costs are lower will have a definite advantage.

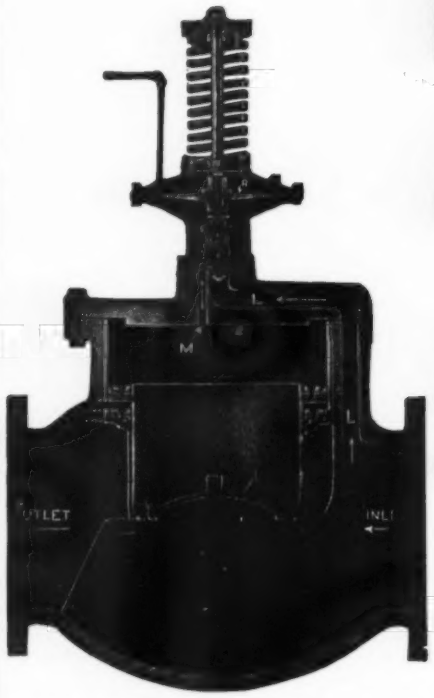
Plan now for the future—plan to effect savings in your power costs. In the past, many efficient power users, in varied industries, have found that in no other department of their business could savings be effected equal to those made by generating power in their own plants with Skinner "Universal Unaflow" Steam Engines and utilizing exhaust steam for heating and processing purposes.

Even though our production facilities are today devoted entirely to the building of Skinner Unaflow Steam Engines for the Army and Navy, our research and engineering departments are available now to discuss your plans for the future.

"The Most Economical Steam Engine Built"

SKINNER ENGINE COMPANY FOUNDED IN 1868 **ERIE, PA.**

GOLDEN-ANDERSON specialty VALVES



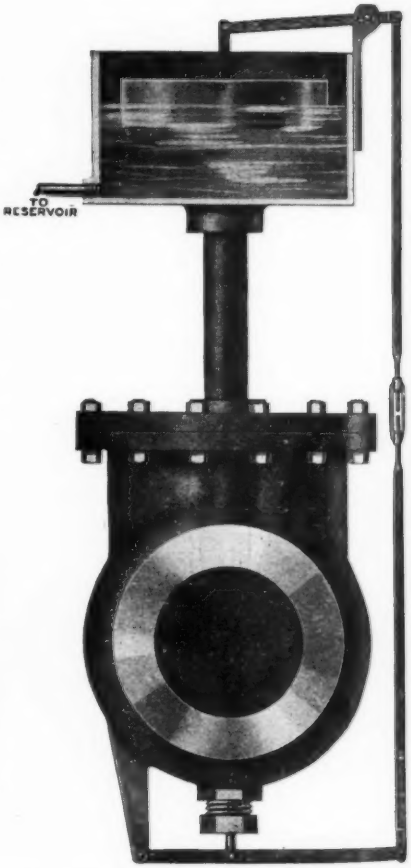
ABOVE—**ALTITUDE CONTROL** — Equip your tanks or standpipes with G-A Altitude control valves . . . get a constant, automatic water level at all times, with no overflow. Positive in action, this valve holds efficiency at an even level, and is cushioned against water or hammer shock. Comes in sizes of 2" to 36", in globe or angle pattern. Full bronze trim is included.

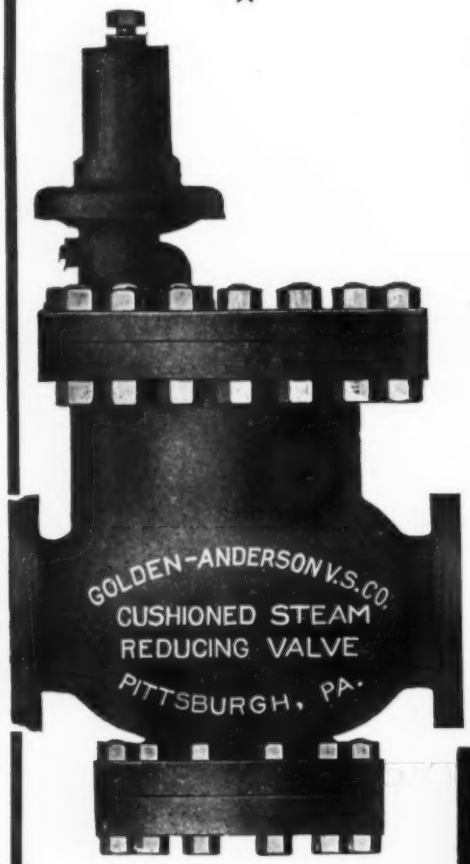
★

. . . MORE YEARS OF SERVICE PER DOLLAR EXPENDED!

● Golden-Anderson Valves have proved their inherent quality and economic value by serving year after year, with little or no maintenance cost, on waterlines and storage tanks throughout the nation. Manufactured quality plus a variety of types and sizes assures you of valves fitted to your special needs. Complete and detailed information on the G-A line may be had on request. Write today!

★





LEFT—**STEAM PRESSURE REDUCING** —Particularly adaptable for intermittent or dead end service, the G-A Steam Pressure Reducing Valve insures uniform terminal pressure on varying capacities. It is furnished in sizes ranging from 2½" to 12" . . . made of Double Extra Heavy cast iron, with a semi-steel or cast steel body and bonnet. Trim consists of either bronze monel metal or stainless steel. This valve will efficiently handle 125 lbs to 400 lbs. of saturated or superheated steam. Pilot control may be located remotely from the main valve.

★

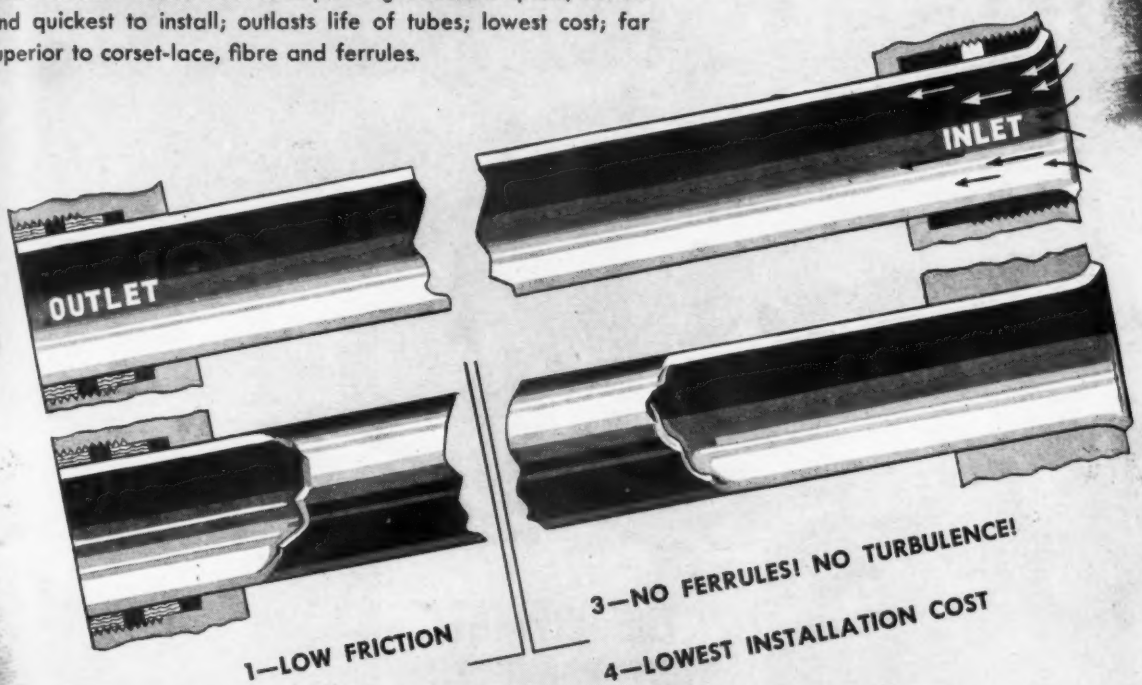
RIGHT—**FLOAT CONTROL**—An all-round efficiency valve, especially suited to water level control in mixing chambers, coagulating basins, etc. In the closed position this valve will seat absolutely tight and it is cushioned to overcome any shock or surge. This G-A Balanced Controlling Float Valve is provided in 3" to 24" sizes . . . has flanged ends with iron body and bonnet and bronze trim.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building · · · Pittsburgh, Pa.

Make CONDENSER *tubes last* MANY YEARS *longer* . . .

10,000 INSTALLATIONS

Naval, Marine and Industrial service proves John Crane Metallic "NO FERRULE" Condenser-tube packing method simplest, easiest and quickest to install; outlasts life of tubes; lowest cost; far superior to corset-lace, fibre and ferrules.



1—LOW FRICTION

2—HIGH CORROSION RESISTANCE

3—NO FERRULES! NO TURBULENCE!

4—LOWEST INSTALLATION COST

JOHN CRANE *Metallic* CONDENSER PACKING

"NO-FERRULE" METHOD FOR NEW AND OLD CONDENSERS

The New John Crane "No Ferrule" method bonds the tube to the tube-sheet in this way:

Illustration top left shows outlet-end of old condenser packed with Metallic and Fibre Expansion Rings. Perfect Bond. Free to expand . . . Inlet-end shows Fibre Expansion Bushing with Lead-slug-insert, bonding tube to tube sheet . . . On new condensers, bottom illustration, inlet-end is packed same as on old units. Outlet-end is belled (no packing). Ask for comparative studies showing advantages of metallic packings over fibre and corset-lace ferrules.

☆

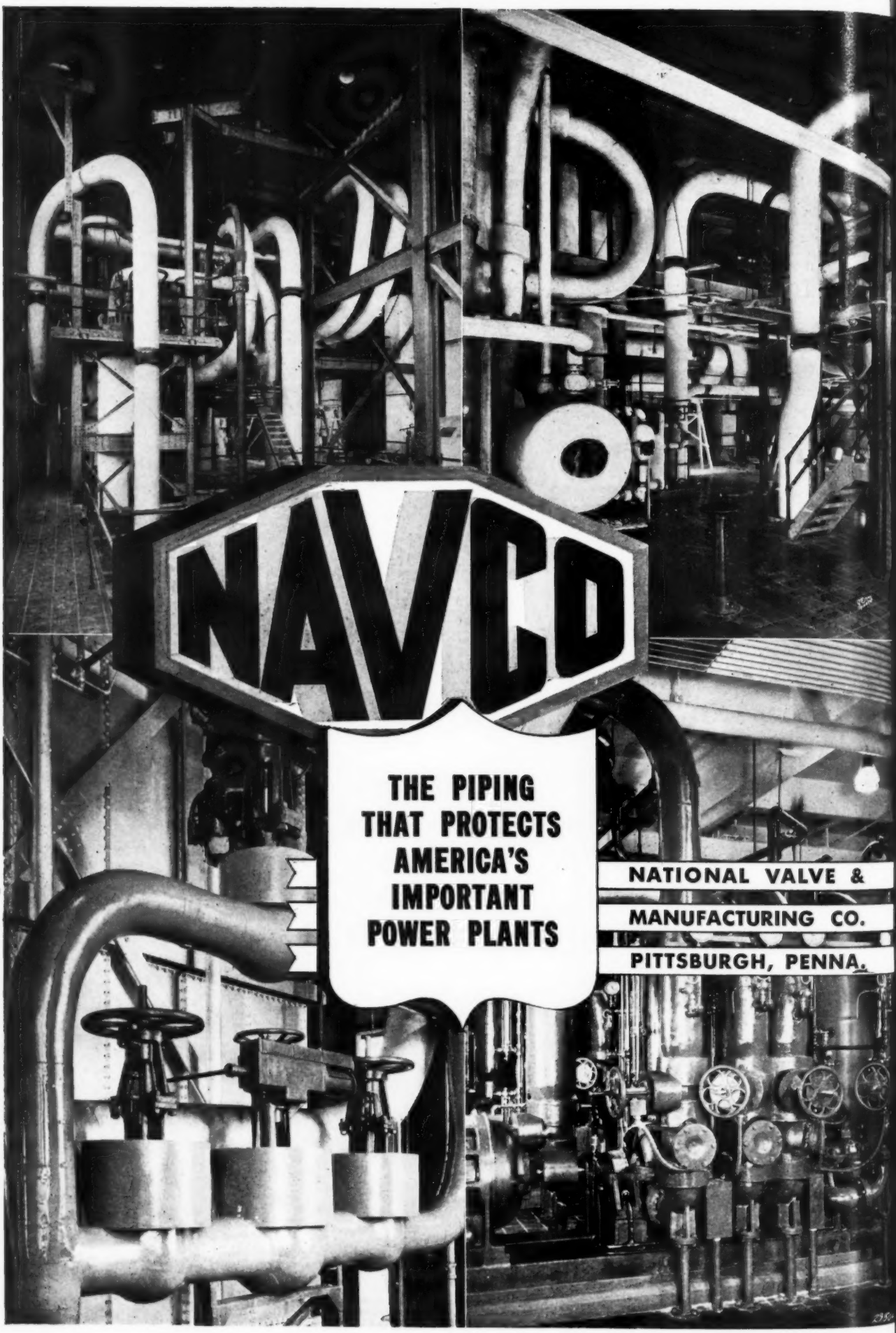
2-OCEAN CONDENSER SERVICE

The only world-wide service of its kind . . . 49 engineers in U. S. A., South America, Canada, England.

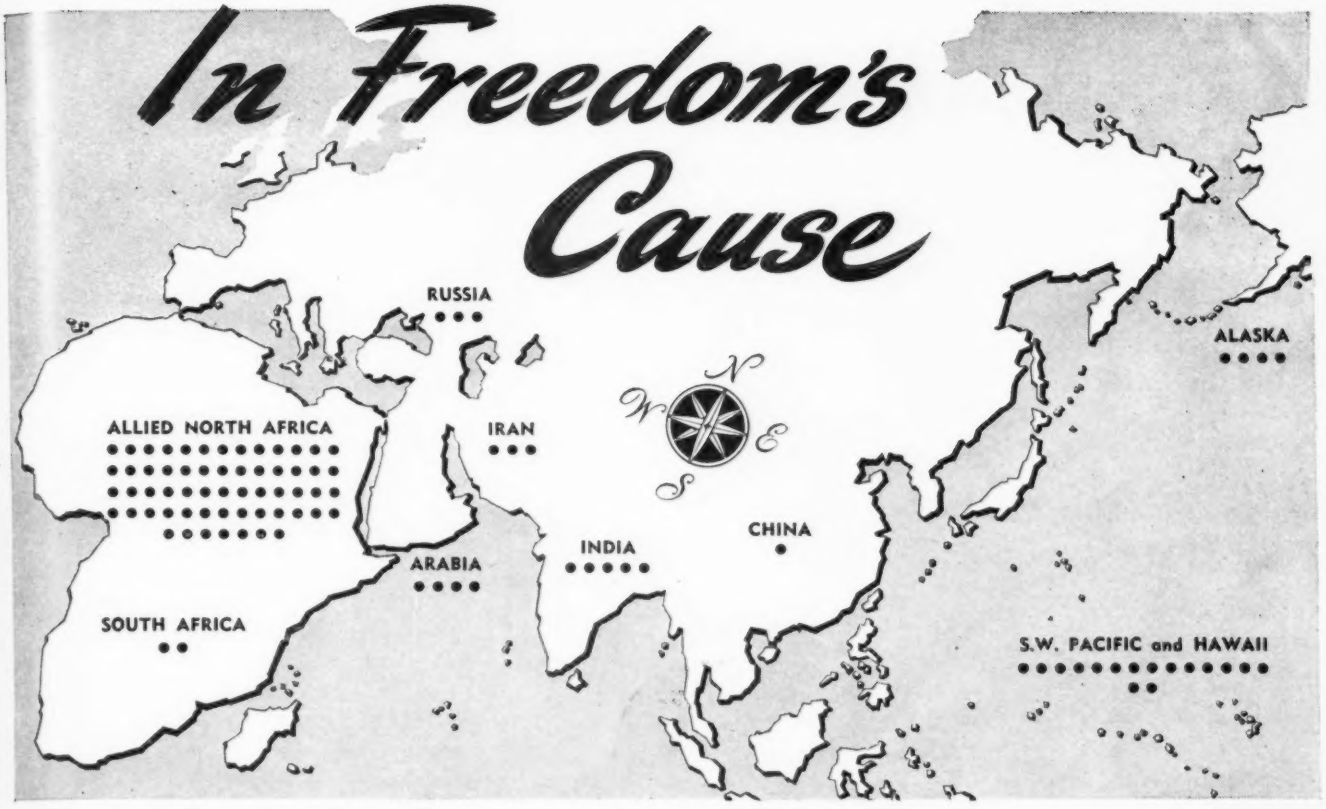
CRANE PACKING COMPANY, 1800 Cuyler Avenue, Chicago, Illinois

Branches: Baltimore, Buffalo, Boston, Cleveland, Dallas, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Tulsa

CRANE PACKING CO., Ltd., Hamilton, Ontario, Canada. Montreal, Toronto, Vancouver


NAVCO
THE PIPING
THAT PROTECTS
AMERICA'S
IMPORTANT
POWER PLANTS
NATIONAL VALVE &
MANUFACTURING CO.
PITTSBURGH, PENNA.

In Freedom's Cause



MARLEY COOLING TOWERS serve United Nations fighters and war industries on all fronts.

In addition to the great number of Marley Cooling Towers now speeding American war production, this map indicates recent Marley exports for service in the active war zones.

FACILITIES and "KNOW-HOW" to do the Job Speedily and Right

America's ability to expand its productive capacity so enormously and so quickly has saved the world from disaster . . . . by producing the *right* equipment to do each job that has to be done . . . . and *ahead of schedule.*

As an example, Marley's production at the start of 1943 is *triple* the same figure for 1942, which was *double* that for 1941 . . . . all on war-vital contracts.

Because Marley had the facilities to swell output swiftly, plants producing essential war supplies have not suffered delay for want of water cooling equipment. And because Marley had the special knowledge and experience to engineer each installation specifically for its job, these plants save much in operating cost and maintenance man-hours.

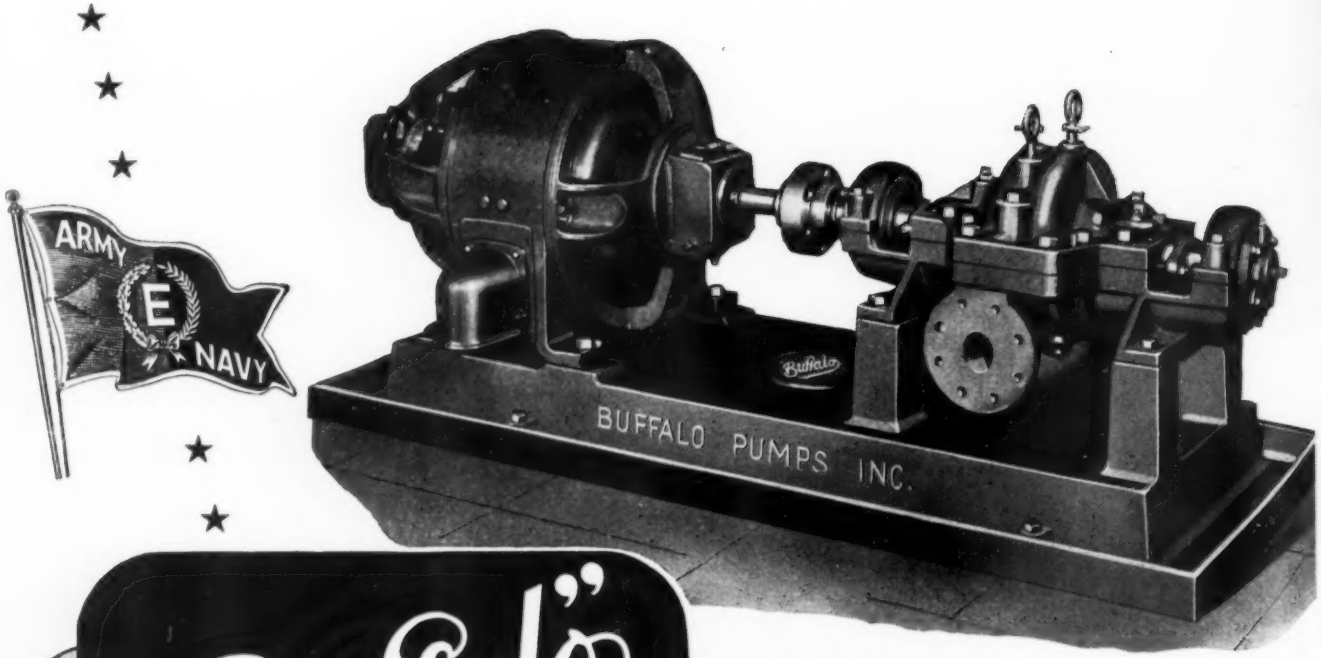
These facilities and this specialized experience have proved to be a definite national asset, and Marley productive capacity is still ahead of demands!

I-43-A

MARLEY COOLING TOWERS

Every MARLEY TOWER *is individually engineered by* THE MARLEY CO., INC. — KANSAS CITY, KANSAS

TEAM-MATES
of
WAR BOILERS



"Buffalo" PUMPS

Yes, Buffalo Boiler Feed Pumps are "right in there fighting"—ably fighting to help Industry's boilers keep steam at peak levels and the wheels of production humming. That's because—long before Pearl Harbor—the Buffalo method of designing and construction took account of emergency needs—and built in an extra margin of stamina. Smooth operating, practically attention-free, Buffalo Pumps are helping *deliver the goods!*

★

BUFFALO PUMPS INC.

488 Broadway **Buffalo, N. Y.**

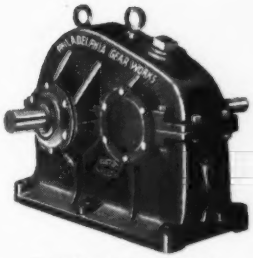
Branch Engineering Offices in Principal Cities

Canada Pumps Ltd., Kitchener, Ont.

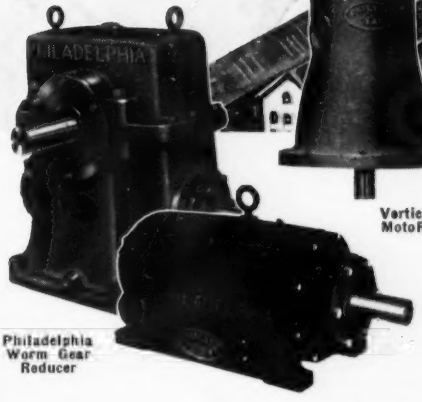
WE'RE *Proud* OF THE MANY PHILADELPHIA SPEED REDUCERS HELPING TO SET UP NEW PRODUCTION RECORDS

Throughout America industrial plants are bettering all peacetime production records because men, management and machines have combined in a common purpose to outproduce the Axis, so that our armed forces can outfight them. In many of these plants Philadelphia Speed Reducers are on the job night and day, transmitting a high degree of input power to the production equipment. The continuous service of so many of these units without requiring attention helps keep machines on the job, and saves much valuable time for maintenance crews.

Philadelphia Speed Reducers are built in all types and in a wide range of ratios and horsepowers. Tell us your requirements—our wide experience will prove helpful.



Philadelphia Herringbone Speed Reducer



Philadelphia Worm Gear Reducer

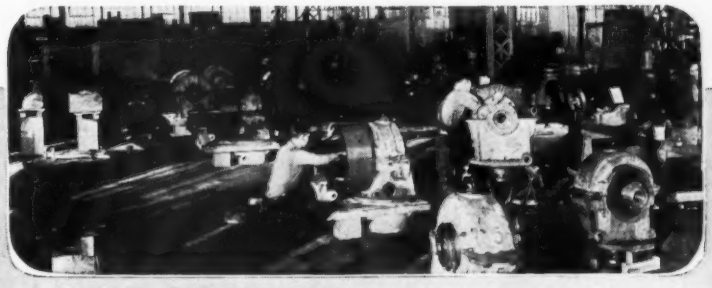
Vertical Type MotoReducer

Horizontal Type MotoReducer

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G ST
PHILADELPHIA,
New York, Pittsburgh, Ch

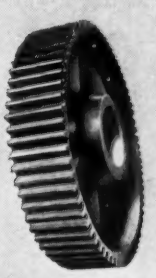


Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

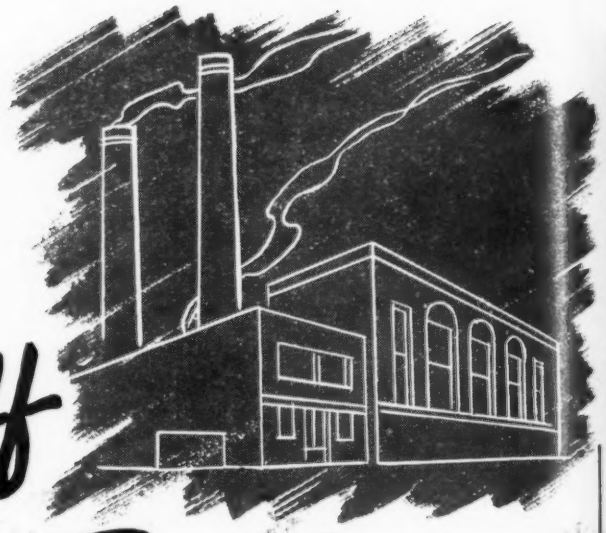
Philadelphia
WORM GEAR SPEED REDUCER
right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.

Philadelphia
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types—various ratios and horsepowers.

Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



Philade
GEA
All types o
of industri
Can be
in all mat



Hats off to the Power Industry

You're doing a swell job . . . meeting the demands of total war — smoothly, efficiently — without fanfare or dramatics.

You've seen kilowatt production reach an all-time peak. You are prepared for demands even more stupendous as 1943 advances. Indications are you'll meet them and with an excess for insurance.

Carey is gratified to have had a part in this great achievement so vital to Victory. Through the use of more Carey Insulation, many central stations and industrial power plants are increasing output, and doing it at big savings in fuel.

With war's insatiable appetite for Power, correct insulation is more important than ever. Get more kilowatts from your fuel and equipment — use CAREY Insulations in thicknesses adequate for maximum results.

A nationwide distribution and engineering organization is at your service. For details address Dept. 16.

SAVE FUEL—INCREASE PRODUCTION—

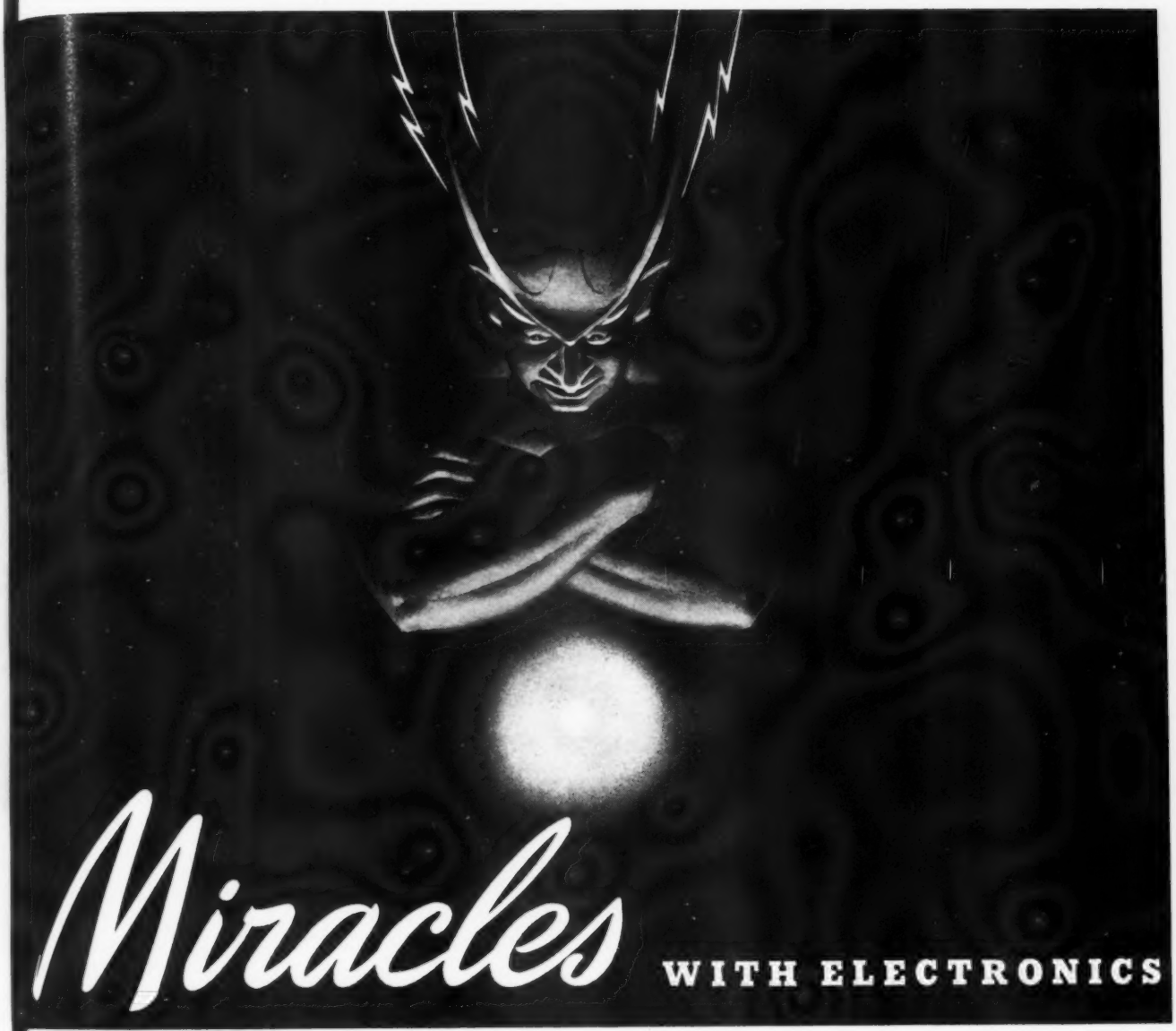
WITH Carey HEAT INSULATIONS

THE PHILIP CAREY MFG. COMPANY

Dependable Products Since 1873

LOCKLAND, CINCINNATI, OHIO

In Canada: **The Philip Carey Company, Ltd.**
Office and Factory: Lennoxville, P. Q.



Miracles WITH ELECTRONICS

ELECTRONICS bids fair to revolutionize our every day living after the war. When Brown and Minneapolis-Honeywell placed experience and manufacturing resources at the call of our government, the result of several years of research in Electronics was immediately applied to instruments — for Testing airplanes in flight — for Controlling production of high octane gasoline — for Treatment of special alloy steels for tanks, guns and armor plate — for Manufacture of synthetic rubber — and for many other purposes entering directly into the war effort.

Extending this peacetime experience to the technique of war, will bear fruit when Peace comes again, in startling new developments in the Electronic control of industrial processes — busily engaged in peacetime production.

Instruments by **BROWN** *and Controls by*

MINNEAPOLIS-HONEYWELL

THE BROWN INSTRUMENT COMPANY, 4490 WAYNE AVENUE, PHILADELPHIA, PENNSYLVANIA
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS, MINNESOTA, AND 119 PETER STREET, TORONTO, CANADA
Wadsworth Road, Perivale, Middlesex England — Nybrokajen 7, Stockholm, Sweden

We have <u>two</u> reasons to be proud of this Flag

First, of course, we are proud of the Army-Navy "E" flag because it is an award to the 3,000 employees of our Richmond refinery. We have long known that their energy, devotion and skill merit the highest praise.

The other reason is that this flag is a harbinger of better days to come, when we will take pride in offering to industry the fruits of Richmond's tremendous war effort.

Today we can only hint at the giant strides our petroleum research and production have made. We cannot publish the specifications of a host of new products, nor the story of how old products have been sensationally improved. We cannot describe the system by which these products are distributed on a world-wide scale.

But we can promise you that, when these facts become known, they will open new horizons for American businessmen and technicians in many fields. They will prove once again that "know-how" can turn yesterday's impossibilities into tomorrow's accomplishments.

In the meantime, the Richmond refinery and all of Standard of California are living up to the "E" flag, helping bring the inevitable victory nearer.

STANDARD OIL COMPANY OF CALIFORNIA

RPM DELO IS USED IN U. S. NAVY DIESELS First used in submarines, RPM DELO performed so well that it is now also used to lubricate high-speed Diesels in the Navy's mine sweepers, sub chasers, landing barges, patrol boats and ocean-going tugs. In all these vessels it is licking some of the toughest lubricating problems in the world. RPM DELO is typical of Standard's development of petroleum products for war.

STANDARD RPM DELO

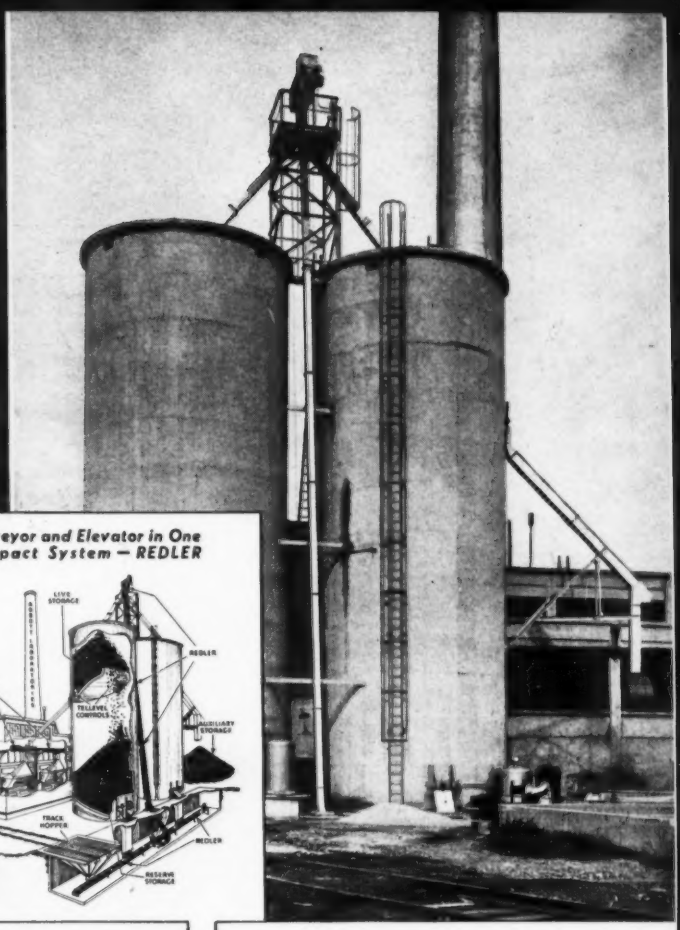
RPM DELO is marketed under the following names:

RPM DELO • Caltex RPM DELO • Kyso RPM DELO
Signal RPM DELO • Imperial-RPM DELO • Sohio RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity

What to Do...

—When War Restricts Liquid Fuel
—Takes Away Men Needed to Handle Solid Fuel



CONVERT to COAL With

S-A Conveying-Elevating Equipment

When you consider the many advantages of coal, remember the handling job which once took so much manpower, can be done automatically. Stephens-Adamson Conveying and Elevating Equipment, designed and built today on the experience of over 40 years, accomplishes this in a variety of ways:

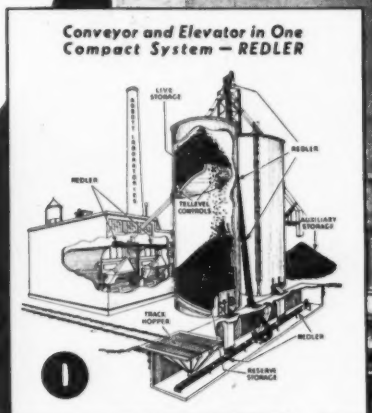
Compact, sealed Redler Conveyor-Elevators move coal in a continuous stream, with a minimum of power consumption and a maximum of efficiency. (Diagram and Illustration No. 1).

Pivoted Bucket Carriers elevate and convey large tonnages of both coal and ash. (Diagram 4).

Gravity Discharge Elevator-Conveyors are built for coal handling requirements of many other types of power plant installations. (Diagram 2).

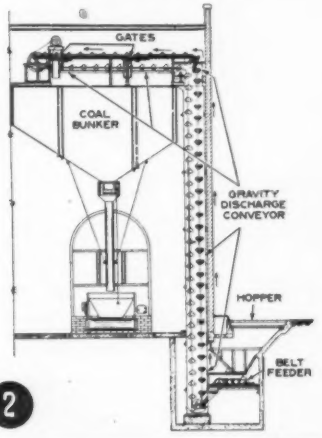
Bucket Elevators and Belt Conveyors, along with various types of Feeders and Crushers engineered and manufactured by S-A are serving power plant operators throughout the country. (Diagram 3).

Conveyor and Elevator in One Compact System — REDLER



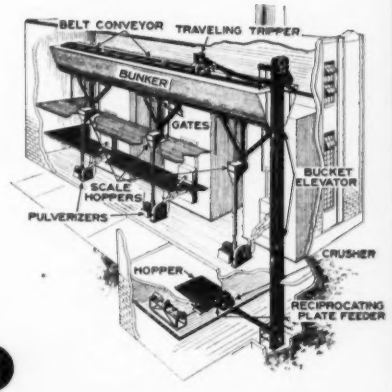
1

Standard Gravity Discharge Conveyor



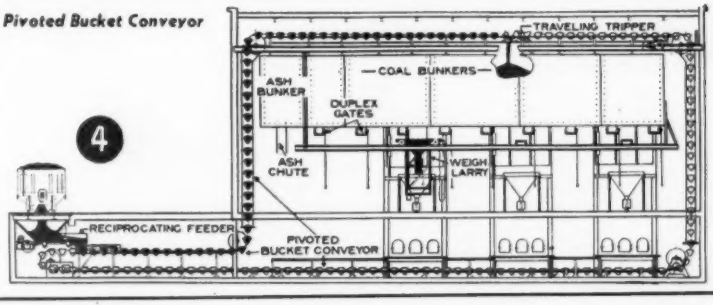
2

Belt Conveyor and Bucket Elevator



3

Pivoted Bucket Conveyor



4

Equipment can be furnished to meet your particular problem. Contact S-A Engineers for details on a coal handling installation which will save you time and money. Write for descriptive bulletins.

STEPHEN S-A ADAMSON MFG. CO.

Chains and Sprockets · Belt Conveyors · Bucket Elevators · Crushers
Bin Gates · Pan Conveyors · SealMaster · Feeders · Screens
Speed Reducers · Redler Conveyors · Ball Bearings · Skip-Hoists · Winches and Car Pullers

5 Ridgeway Avenue, Aurora, Illinois

THEY STARTED with a lot of wind!

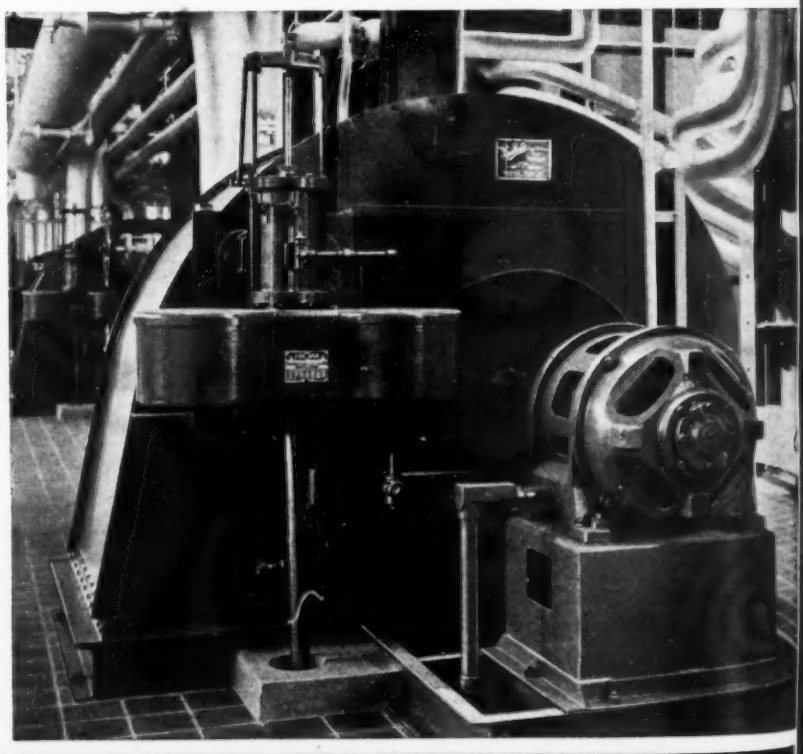
It's a far cry from "block busters" to boiler draft—yet Victory's bombs and other armament get their start with the mechanical "wind" that keeps Industry's boilers perking, generators humming and production machinery turning at top speed . . . Buffalo Forced & Induced Draft Fans are on the job day and night, handling emergency demands in stride, supplying mechanical draft with unfailing dependability to power plants large and small—just one phase of Buffalo's many contributions to war production.

BUFFALO FORGE COMPANY

488 Broadway Buffalo, N. Y.

Branch Engineering Offices in Principal Cities

Canadian Blower & Forge Company, Ltd., Kitchener, Ont.



ARMY E NAVY

"Buffalo" MECHANICAL DRAFT FANS

FOR EFFECTIVE BOMBING!

The Coordinated efforts of . . .

THE PILOT
THE BOMBARDIER
THE NAVIGATOR

FOR EFFECTIVE WATER CONDITIONING!

The Coordinated efforts of . . .

THE CHEMIST
THE CHEMICAL ENGINEER
THE MECHANICAL ENGINEER

The Bird-Archer Co. is a balanced organization composed of Chemists, Chemical Engineers and Mechanical Engineers who have had practical operating experience —who know and understand the generation of steam and its feed water problems.

SURVEYS . PLANT STUDIES . CONSULTATIONS . TREATMENTS

THE BIRD-ARCHER CO.

Scientific Water Conditioning

SINCE 1885

New York, N. Y.
400 Madison Ave.

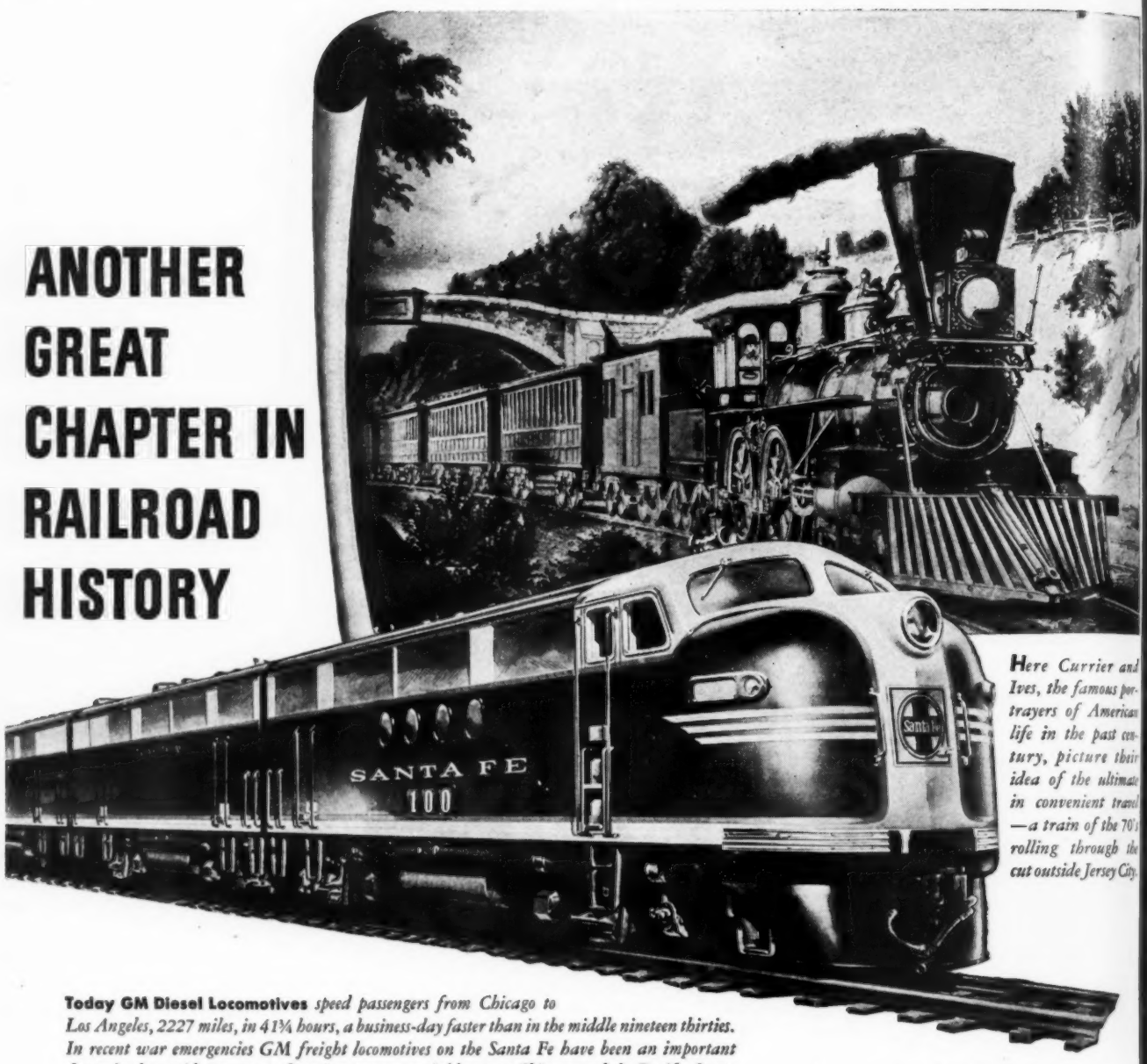
Chicago, Ill.
Wrigley Building

Philadelphia, Pa.
4337 No. American St.

The Bird-Archer Co. Ltd.
McGill Building, Montreal, Canada

3-BA-1

ANOTHER GREAT CHAPTER IN RAILROAD HISTORY



Here Currier and Ives, the famous portrayers of American life in the past century, picture their idea of the ultimate in convenient travel —a train of the 70's rolling through the cut outside Jersey City.

Today GM Diesel Locomotives *speed passengers from Chicago to Los Angeles, 2227 miles, in 41¼ hours, a business-day faster than in the middle nineteen thirties. In recent war emergencies GM freight locomotives on the Santa Fe have been an important factor in the rapid movement of precious war material between Chicago and the Pacific Coast.*

Pages will be turned too in farm and industrial history. For GM Diesels will be ready to serve wherever America needs power.

THE history of America is a history of progress in transportation. ★ This history is not completed. ★ General Motors locomotives have turned a new page in this record of progress. ★ The flowering of this new era when peace again returns is foretold in the tremendous strides already taken in meeting the challenges of war today.

GM
GENERAL MOTORS
DIESEL POWER

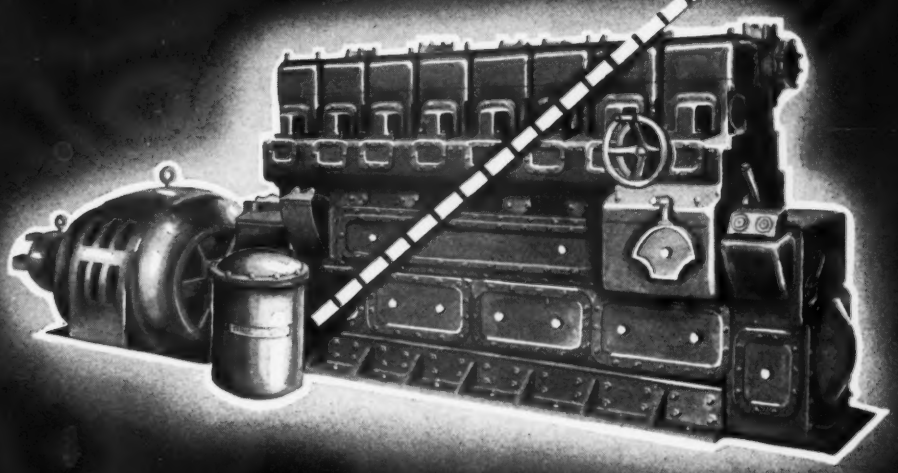
LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.

ENGINES..300 to 2000 H.P...CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

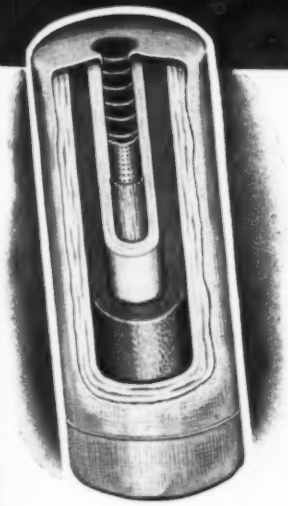
ENGINES.....15 to 250 H.P.....DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.

HOW

TO MAKE YOUR ENGINE LAST LONGER★



HILLBERG



When *every drop* of oil which lubricates your engine is kept physically clean and chemically pure, like the original oil that comes from the refinery, you add thousands of operating hours to your engine's life.

Briggs Oil Clarifiers assure proper engine maintenance by keeping the oil "refinery pure" day in and day out. Each time the oil passes through the clarifier it is cleaned, not once, but three times!

Three-phase clarification is done in a single refill cartridge. First, special cellulose removes all solid abrasives. Then Briggs Fuller's Earth Blocks ADsorb acids, resins and gums as they form in the oil. More layers of cellulose give the oil a final "polishing", removing microscopic solid particles.

Only Briggs Clarifiers contain bonded, porous blocks of Fuller's Earth. Protect your engine and conserve oil by installing a Briggs Clarifier today.

BRIGGS Clarifier CO.

1339 WISCONSIN AVE. WASHINGTON, D. C.

VICTORY IS UP TO YOU . . . BUY WAR BONDS

Eliminate Air . . .
Cut Corrosion . . . Stop Leaks
. . . Use FLOWRITES . . .
Shock Test . . . Stretch . . . Save the Tubes You've Got

In holding down condenser maintenance costs, the Big League Utilities have kept our facilities and our field crews busy for seventeen years.

Costs are now secondary. To keep power always available to war production with the least tonnage of copper, find out about Conseco nation-wide, clock-around service.

AIR AND EROSION ELIMINATORS

These removable screen plates, fitted with air ejection piping, remove air from circulating water before it attacks tube sheets and tube ends. Increase tube life from three to seven times, in the average installation.

SHOCK TEST

The 10-year-old hydrodynamic Shock Test destroys tubes just ready to fail. Frequently, less than ten per cent of the tubes in large condensers require replacement, but only by shock-testing can you know good tubes from bad.

STRETCH WORN TUBES

Even a tube with the ends worn through can be salvaged. Let us, by shock-test, eliminate every tube incapable of further service, stretch the usable tubes, cut off the bad ends and return the useful lengths to service.

FLOWRITES

Replaceable, bell-mouthed FLOWRITES provide smooth, directed flow of circulating water, preventing gas-caused erosion of tube ends.

"WIZARD" INJECTORS

Open a pair of valves to the steam line, inject "Wizard" Leak Compound. Stops tube leaks within seconds.

"CONDENSER SERVICE"

A letter, telegram or 'phone call will start your job rolling. Estimates furnished for specific work.

CONDENSER SERVICE & ENGINEERING CO., INC.

SEABOARD BANK BUILDING — HOBOKEN, NEW JERSEY

A sectional view of the Type 45 Foster Siren showing valve for manual operation. This size has an 18 inch diameter horn.

Is your air-raid warning system adequate?

Before you order additional sirens . . . Check these points

1
Are they available now?

We have a supply of Foster Sirens *in stock*. And—as they are manufactured of fewer non-critical materials than many other sirens, a correspondingly lower priority is required.

2
Are they sufficiently audible?

The Foster Siren has one of the widest ranges of audibility—one of the highest decibel ratings. The Type 45, for example, produces a sound level of 125 to 130 decibels at 100 feet—and is non-directional.

3
Are they adaptable to existing conditions?

This siren may be manually operated, or you can add a solenoid valve for electric remote control . . . either for separate push-button operation, or tied in as an integral part of an air-raid warning, fire-alarm or other signal or coding system.

4
Are they expensive?

On the basis of "dollars per decibel", the Foster Siren is lower in price than any siren manufactured, according to the latest figures available. The initial cost is not only low, but installation costs are far below those of sirens of comparable audibility.

Send for Bulletin 29

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK, N. J.

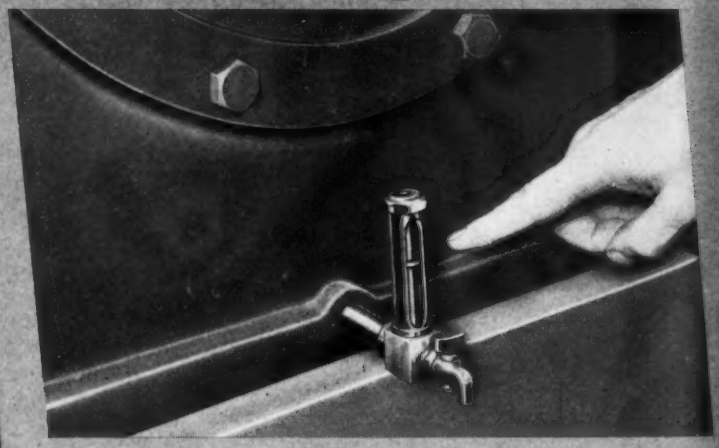
Compressors, too, are working hard these days—

PROPER LUBRICATION IS MORE IMPORTANT THAN EVER

Built into Chicago Pneumatic horizontal stationary compressors are force feed cylinder lubrication and a highly efficient flood system of frame lubrication. These lubricating systems require only minimum attention on the part of the operator —a few simple check-ups which, however, should be made regularly.

Additional suggestions for maintaining compressor efficiency will appear in future advertisements. Watch for them.

HOW TO GET MAXIMUM OPERATION FROM YOUR CP COMPRESSORS



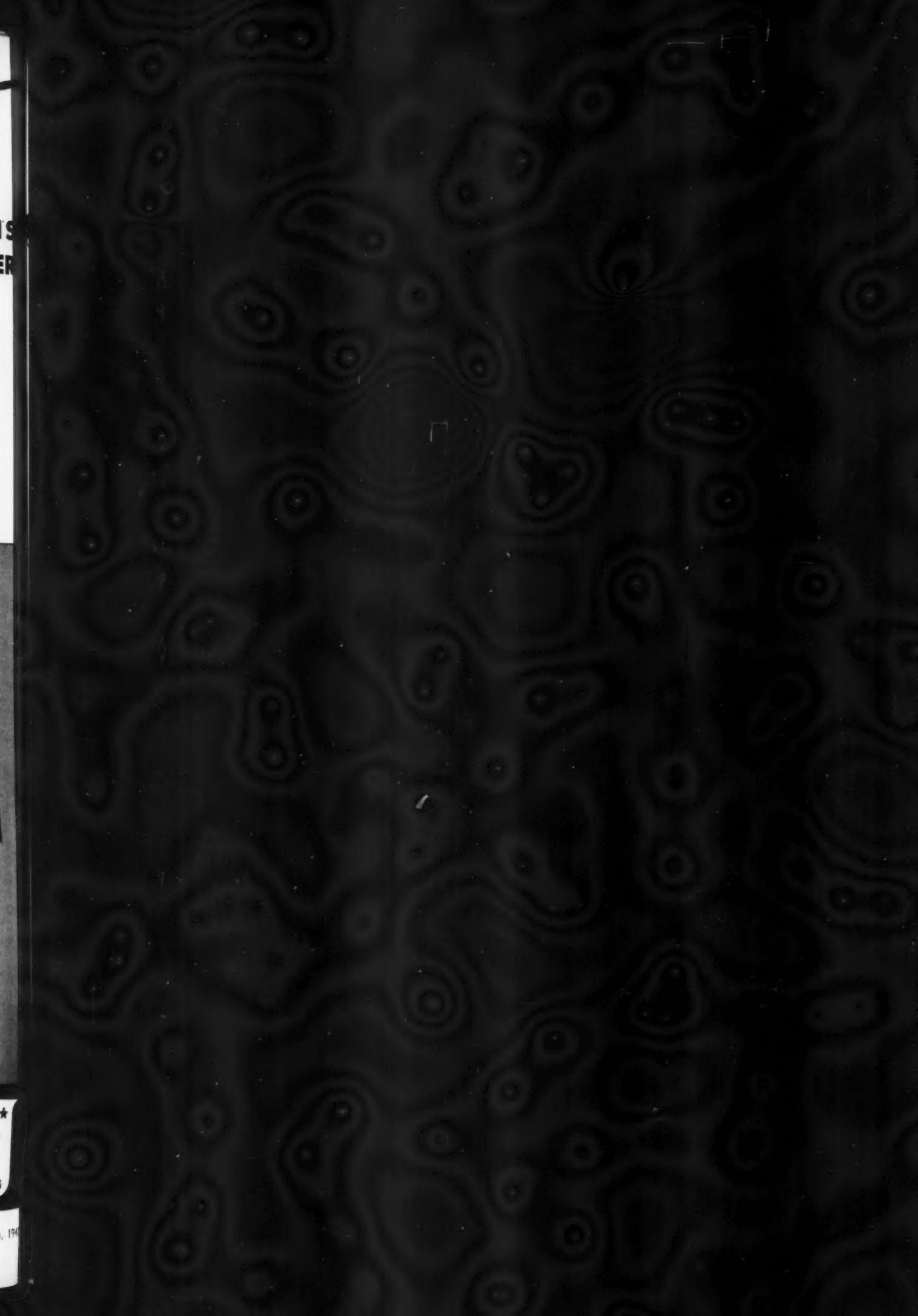
Bearings will not run without oil. Keep oil in crank case at level indicated on oil level gauge (illustrated). Drain, clean, refill reservoir at least once a month — more frequently if local conditions require.

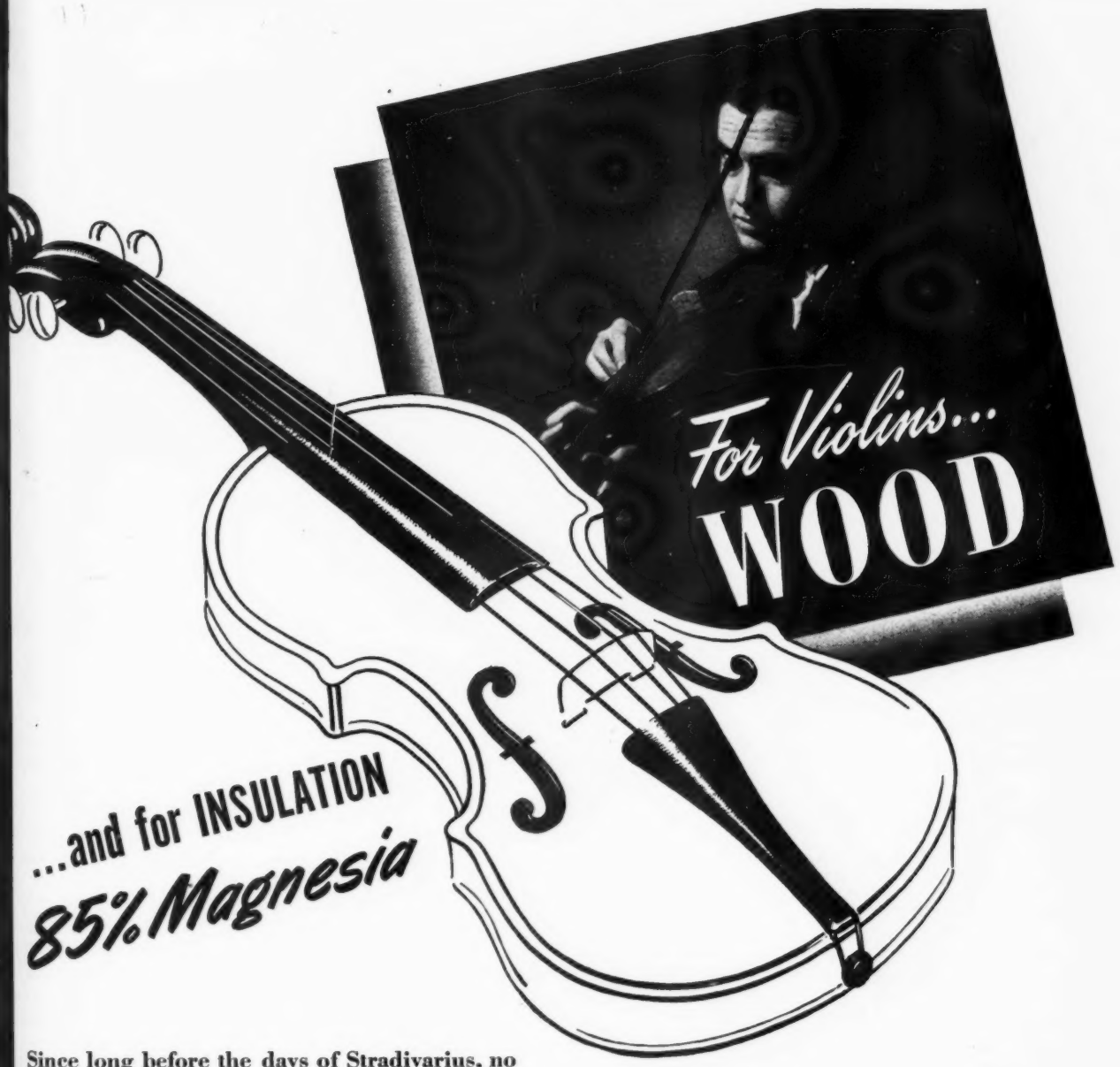
← At least once a day, check the force feed cylinder lubricator, making sure reservoir is filled to required level. Make certain that lubricator is feeding only the number of drops per minute recommended for your particular size of compressor — too much oil results in carbon formation and overheating.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL CP COMPANY
General Offices: 8 East 44th Street, New York, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES





...and for INSULATION 85% Magnesia

Since long before the days of Stradivarius, no substitute has been found to take the place of wood in a violin. Time has proved it the *one* material for the purpose.

And in the field of industrial heat insulations, 85% Magnesia is the *one* material that has proved its ability to maintain efficiency . . . decade after decade. Records of more than half a century confirm this statement.

It will pay you to continue to specify and use Ehret's 85% Magnesia.

EHRET'S 85% MAGNESIA and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the new 176-page Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy.

HRET MAGNESIA MANUFACTURING CO.

Ehret

VALLEY FORGE, PENNA.

. . . THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

This Year Rubber Is Tapped from Test Tubes

Synthetic Rubber Already Is Working for Users of Mechanical Rubber Goods

War production is up threefold. But the vital rubber stock pile is dwindling fast. This is the year of crisis in rubber.

There is only one solution . . . the production of synthetic rubber in steadily increasing tonnages . . . synthetic rubber to take over jobs once handled by natural rubber . . . to perform new tasks, serve in new applications created by wartime need.

One of the first synthetic rubber plants in the Government's program was built and is being operated by United States Rubber Company . . . another soon will be in production.

Our engineers have been working with synthetic rubber since 1921. During this period they have learned that no one synthetic should be used for all types of mechanical rubber goods. They have found where and how synthetic is superior to natural rubber, where it is equally as good, where it falls short. They know what uses each of the five basic commercial types of synthetic rubber is best suited for — Neoprene, Buna-S, Buna-N, Butyl, or Thiokol—and how to compound the specific synthetic rubber for the specific task. U. S. Rubber has used all five types and knows which one to select for the performance required.

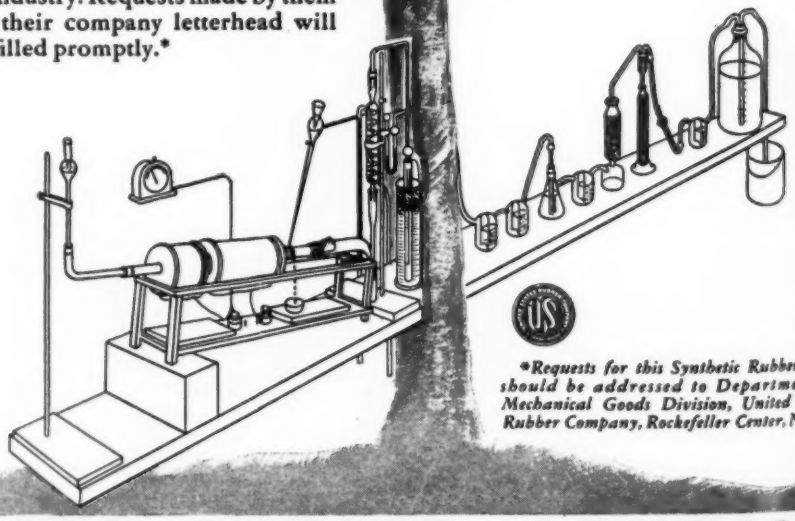
Information based on the results of vast experiments and practical applications of synthetic rubber has been incorporated in a new comprehensive book, *The Five Commercial Types of Synthetic Rubber.*

This informative book traces the history of synthetic rubber from the earliest experiments of Michael Faraday to the present. It discusses each of the basic types of synthetic rubber, tells where it has been used successfully in United States Rubber Company products, and compares its properties with natural rubber. It tells how synthetic rubber is made. It is a detailed answer to the most vital question of the day.

We feel that *The Five Commercial Types of Synthetic Rubber* is a publication of real importance to men of industry. Requests made by them on their company letterhead will be filled promptly.*

The successful use of synthetic rubber in mechanical rubber goods and the insurance of fully dependable service depend largely upon the skill of the manufacturer and compounder. Each of the five basic commercial types of synthetic permits a myriad of variations.

The United States Rubber Company has been developing and improving rubber products for one hundred years. Today, the same vast resources for research and development that resulted in some of the most spectacular achievements in the rubber industry are being devoted to the problem of synthetic rubber. A great backlog of knowledge already has been built. More is being constantly added.



**Requests for this Synthetic Rubber Book should be addressed to Department 6, Mechanical Goods Division, United States Rubber Company, Rockefeller Center, N.Y.C.*

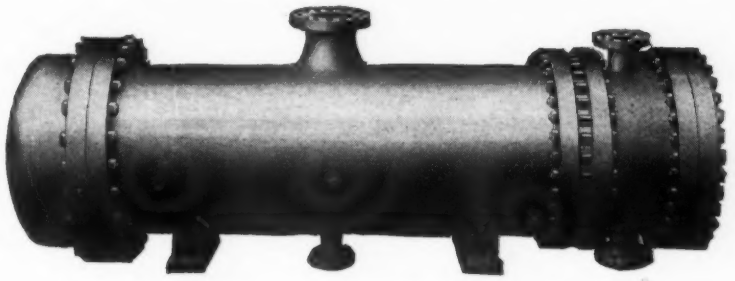
UNITED STATES RUBBER COMPANY

Mechanical Rubber Goods Division • Rockefeller Center • New York

In Canada, Dominion Rubber Co., Ltd.

FEED WATER HEATER EQUIPMENT

for High, Intermediate, or Low Pressure Service



Lummus-designed and Lummus-built boiler feed water heaters are operating at pressures as high as 1200 pounds per square inch. Numerous Lummus units are in service in the intermediate and low pressure fields.

Lummus heat exchangers are available in all pressure ranges employed in modern power plants. Lummus heat exchanger equipment also includes Surface Condensers, Steam Jet Air Pumps, Fuel Oil Heaters, Lubrication Oil Coolers.

Lummus engineering personnel and construction facilities are available to public utilities and industrial power plants requiring equipment to meet specific conditions. Write for further information.

THE LUMMUS COMPANY
420 Lexington Ave., New York, N.Y.

LUMMUS

They Speak a Language the Japs Understand

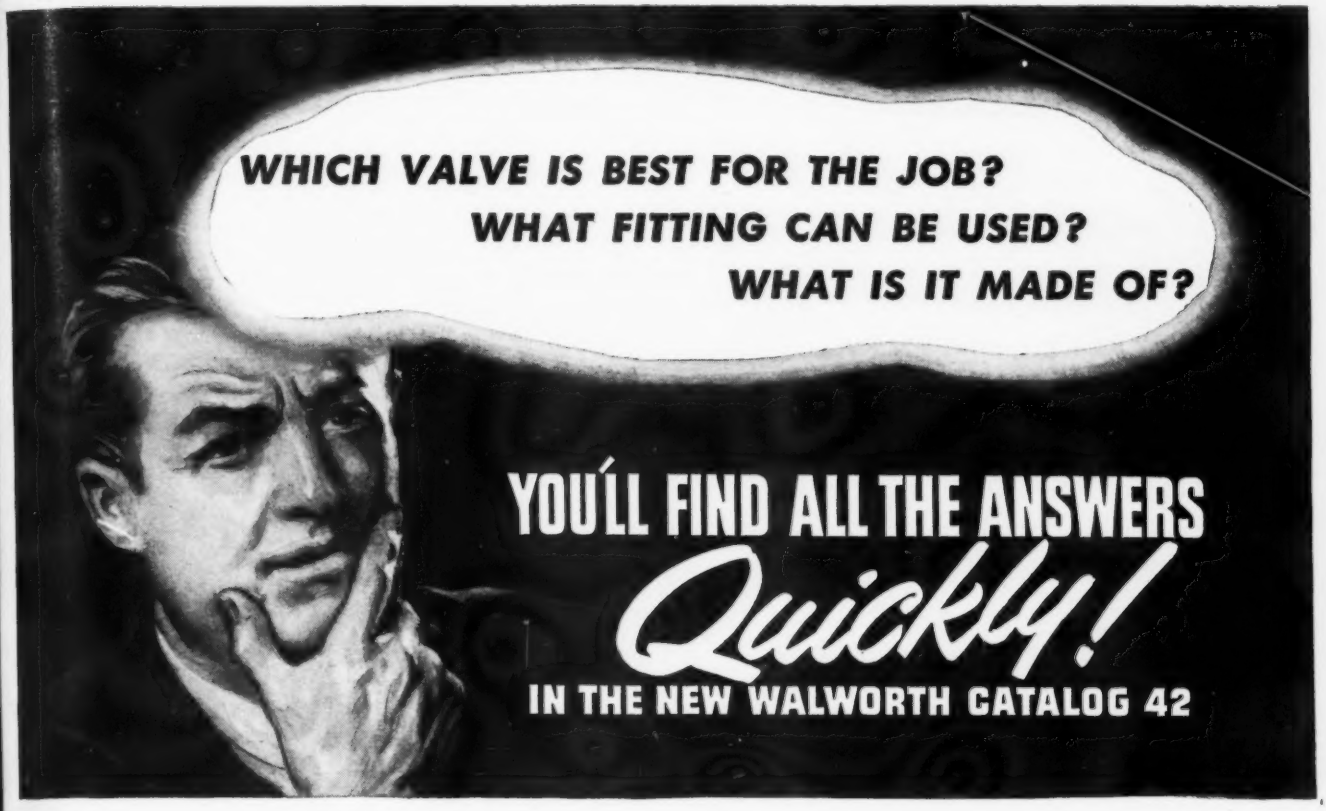
FIRE ONE! FIRE TWO!

From the first day of this war, the crews of U. S. submarines have thus "reasoned" with the enemy—and in his own waters.

They know *action* and *engines*—for they literally live with and by the Diesels which take them there and bring them back.

Many of these Diesels are Fairbanks-Morse Diesels. We feel that nothing short of our level best is good enough for these men of the silent service.

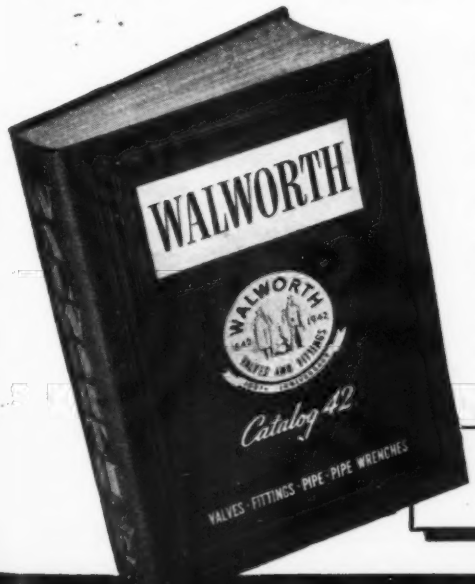
FAIRBANKS, MORSE & CO.


WHICH VALVE IS BEST FOR THE JOB?
WHAT FITTING CAN BE USED?
WHAT IS IT MADE OF?
YOU'LL FIND ALL THE ANSWERS
Quickly!
IN THE NEW WALWORTH CATALOG 42

Be right the first time and every time — specify the exact Walworth valve, fitting, pipe, and tool you need from this new Walworth Catalog 42. Complete and up-to-date information is given on every Walworth product to help you save time in ordering.

Pressures, dimensions, engineering data, and other helpful information are given in clearly indexed sections of the Catalog.

If you haven't your copy of the Walworth Catalog 42, fill out the coupon and mail it today. Transportation priorities may slow up deliveries, so allow a little more time than usual for shipment of your copy.



Metals — Complete data on all metals used.

Pressures — Working and test pressures, plus service recommendations.

Dimensions — Complete for layout and operation, with cross sections to clarify internal construction.

Telegraphic Code — Carefully indexed to simplify and speed up accuracy in specifying.

Engineering Data — Charts, tables, formulae to make valve and pipe installations easier.

USE THIS COUPON

Address your inquiry to Dept. **35**, *Walworth Co., 60 East 42nd St., N. Y. C.*

Please send a copy of the new Walworth Catalog 42 to:

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

WALWORTH

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

VALVES FITTINGS and TOOLS
Backed by 101 Years' Service

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

PACKINGS chart a course to Victory!

RECOMMENDATION CHART FOR THE USE OF BELMONT PACKINGS

APPLICATION	RECIPROCATING RODS AND PLUNGERS	CENTRIFUGAL AND ROTARY SHAFTS	GLOBE AND ANGLE VALVE STEMS	SHEET PACKINGS	GASKETS
	Style	Style	Style	Style	Style
STEAM High Pressure 340°F. and over	30 Asbestos Spiral Rubber Back 47 Asbestos Spiral Rubber Center 866 Semi-Metallic 745 Braided Asbestos Square 329 Asbestos Hollow Center	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 4010 Plastic (over 550°F.)	655 Braided Asbestos, Vulcanized 610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 4010 Plastic (550°F.) 2001 Shredded Metal (up to 550°F.)	590 Compressed Asbestos 591 Compressed Asbestos 595 Compressed Asbestos 603 Woven Asbestos W.I. 611 R. & B. Woven Asbestos W.I.	589 Compressed Asbestos 588 Compressed Asbestos 596 Compressed Asbestos 625 Woven Asbestos W.I. 629 R. & B. Woven Asbestos W.I.
STEAM Intermediate and Low Pressure under 340°F.	319 Hollow Center 1000 Cross Expansion 102 Extra Rubber and Duck 2 Expansion Channel 203 Combination Diagonal H.P. 204 Combination Diagonal 85 Combination Set, High Speed	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 2001 Shredded Metal	610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 2001 Shredded Metal	602 Black Sheet	642 Black Sheet

While these recommendations are based on years of experience, no guarantees are made in view of the many peculiarities that may center around one application as compared with another of similar nature. Consult with us for special or unusual services.

VICTORY is the target at which we're shooting, and though it's only little over a year since the scrap began . . . production, the big gun of America, is now scoring bulls' eyes.

Spouting from the assembly lines throughout the Nation are the planes, guns, tanks, ships and other essentials so necessary to this all-out war effort. To keep these weapons pouring forth is the job that faces industrial America today.

Men are working longer, machines harder. Under this terrific strain wear in equipment is bound to be more prevalent. Extra precautions must be taken or vital parts are apt to go, losing time our most precious asset in this battle of mechanization.

Packings play their part in this gigantic production program. This advertisement is published as an industrial service to help save your time when a packing selection must be made. If the problem is steam, this chart will guide you in making the proper Belmont Packing selection to meet your requirements.

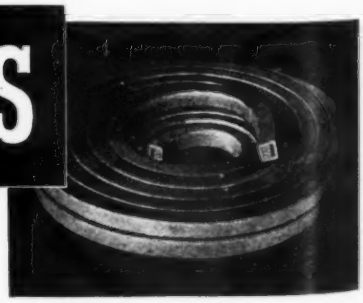
THERE'S A BELMONT PACKING FOR EVERY SERVICE . . . Steam, Water, Oil, Gas, Air, Acid, Alkalis, Ammonia. FORMS INCLUDE . . . Rings, Coils, Spirals, Reels, Spools, Sheets, Gaskets.

Belmont Packings are Sold by Authorized Belmont Distributors in Every Large Industrial Center

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

● For those desiring more detailed information the Belmont Catalog is available. This book contains 84 pages of packing information reduced to its simplest form. All types of Belmont Packings are illustrated and described. Packing end views are pictured in large size showing minute details. Constructions, applications, tables of weights, all are included. The Belmont Packing Catalog has been prepared by packing engineers. It's a book you should not be without. Write on your Company letterhead for your copy, today.

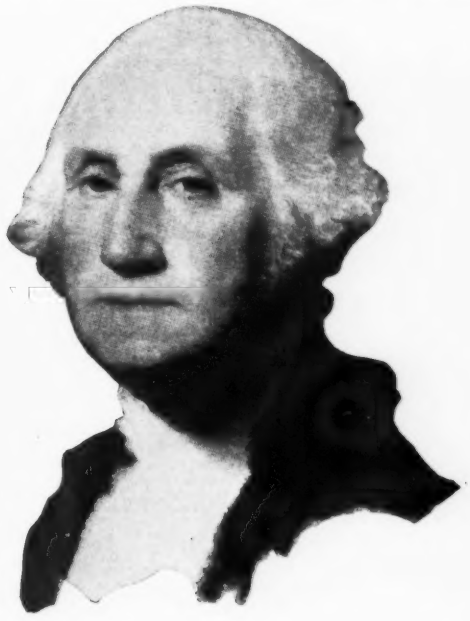
BELMONT PACKINGS



THE BELMONT PACKING & RUBBER COMPANY

DEPT. P-3-43

BUTLER AND SEPVIVA STREETS • PHILADELPHIA, PENNSYLVANIA



Why is this Taylor Recording Thermometer Like the Father of Our Country?

YOU'VE guessed it. George Washington couldn't tell a lie—and neither can a Taylor Mercury-Actuated Recording Thermometer! The reason is Taylor "Accuratus" Tubing—a special, precision-bore, all-welded tube system that insures accurate temperature recordings at a central control panel—as far as *100 to 200 feet away from the bulb!*

This just wasn't possible with ordinary connecting tubing. A hot or cold zone along the way could make the whole recording worthless. But Taylor Accuratus Tubing has a special alloy wire inside, with a coefficient of expansion so related to the tubing and the mercury that any variations in temperatures along the tubing are counteracted on the spot! The result is Accuracy.

Futhermore, a mercury-actuated system gives you the exclusive advantage of short ranges with open chart graduations anywhere within the limits of —40° to +1000°F.

Why not start planning now to install Taylor Recording Instruments as soon as the war is over? Your Taylor Field Engineer can show you a wide variety of connecting tubings and bulb and well constructions, including the famous Taylor "Thermospeed" separable well construction. Write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, flow, humidity, and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

★ KEEP ON BUYING U. S. WAR BONDS AND STAMPS ★

Tube cleaning takes -a new turn

-with the new

ELLIOTT

1300 Series

TUBE CLEANERS

"Tube Cleaner Headquarters" has done it again— stepped up the tempo and the power of cleaning equipment with new developments of far reaching significance. These are particularly aimed at facilitating the cleaning of short radius curves and bends of modern boilers.

1 The new ELLIOTT HINGE COUPLING

2 The new ELLIOTT more powerful motor

3 The strong ELLIOTT cutter head universal joint

The new Elliott hinge coupling takes all the stiffness out of the connection of hose and motor. It is notably strong, assembled "for keeps," and slips easily to the angle required by the tube turn. The new Elliott 1300 Series motor is handier, more powerful, and its design includes a lubrication system which insures a new standard of generous lubrication for *all* bearings — front as well as rear. Means longer service, of course — and also less maintenance, and the transmitting of *more* power to the cutter head.

Check on these major developments. Write us

ELLIOTT COMPANY

Tube Cleaner Department
SPRINGFIELD, OHIO
DISTRICT OFFICES IN PRINCIPAL CITIES

STUDENT WELDERS
LEARN PROPER FLAME ADJUSTMENT FASTER

Oxyacetylene flame adjustments*
Acetylene burning in air
Strongly Carburizing Flame
Slight Excess Acetylene Flame
Neutral Flame
Oxidizing Flame
These natural color photographs will give the student an accurate guide for adjusting the oxyacetylene flame. Correct flame adjustment is so vital to successful welding that the best manipulative skill is lost unless the flame adjustment is correct.
Compliments of
AIR REDUCTION

with this natural color oxyacetylene flame adjustment chart

Student welders and "beginners" learn to make correct flame adjustments more quickly when they are guided by an Airco oxyacetylene flame-color chart. This helpful chart shows full color illustrations of the principal flames used for welding metals.

It makes it easier for the beginner to make sound, strong welds by clearly showing the appearance of the neutral flame which he will use most frequently in oxyacetylene welding. The excess acetylene flame is also shown, as well as the oxidizing flame used for welding copper and copper alloys.

Since the first requisite to good welds is correct flame adjustment, every student welder will benefit by using this flame chart as his guide.

We will be glad to send you, without charge, as many copies of this chart as you need. Mail the coupon and please indicate the quantity you require.

AIR REDUCTION

AIRCO

60 EAST 42nd STREET, NEW YORK, N. Y.

In Texas: Magnolia-Airco Gas Products Co.

AIR REDUCTION Advertising Dept.
60 East 42nd Street, New York, N. Y.

Please send_____copies of the full color flame adjustment guide to:

*Name*_____

*Position*_____

*Company*_____

*Address*_____

IDLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!

WeldELLS have everything ★

FULL WALL THICKNESS HERE
The amount by which stress is greater at the crotch in a fitting having uniform wall thickness depends only on its radius. Mathematical analysis (specifically the Lorenz formula) shows the stress at the crotch to be:
$S = \frac{pr\,(2R - r)}{2t\,(R - r)}$
Where:
S = Bursting stress, lbs. per sq. in.
p = Internal pressure, lbs. per sq. in.
r = ½ inside diameter of fitting (O.D. if Barlow's formula is desired).
t = Wall thickness in inches.
R = Center line radius of fitting, inches.
REINFORCED HERE

It's a feature that tells the whole story . . .

TO the kind of engineer we're thinking about, *nearly right* is not right enough. He's the kind of fellow who makes sure that the strength of every part is as nearly proportionate to the stress imposed on it as exacting calculation can make it. To him, nothing less is *right*.

The feature of WeldELLS, pictured above, is certain to strike a responsive chord in such a man. It is based on mathematical calculations and practical tests which prove that the bursting stresses in an elbow are greatest at the crotch or inner wall —and show just how much greater.

In keeping with this finding, WeldELLS are given extra reinforcement in this region of greatest stress. To us, as to you, nothing less would be right!

We are not implying that welding fittings which lack this feature are bursting right and left. We are simply showing that in this, as in other features listed opposite, we have gone the engineering limit to make WeldELLS the fittings that have *EVERYTHING*.

Don't you agree that nothing less is right for *your* piping job.

★ No other fittings for pipe welding combine the features found in WeldELLS. In addition to that described, they include:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress — simplify lining up.
- **Precision quarter-marked ends** — simplify layout and help insure accuracy.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** —assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** —insures complete service and undivided responsibility.

PRODUCTS VITAL TO MODERN WARFARE

WeldELLS are only one of many Taylor Forge contributions to the war effort. One of many examples is Taylor Corrugated Marine Furnaces, essential to many merchant and fighting ships.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485

NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING

Something
to think about
ARMY
E
NAVY
OIC
On your requirements for bronze,
n and steel valves, OIC Distributors
n serve you better.
They save you time and money by
nsolidating many items in one order.
They give you valuable personal
vice through their knowledge of your
intenance needs.
They give you prompt price, catalog
d priority information.
They insure you prompt service from
ir stocks of OIC valves.
There is an OIC Distributor near
u. Call him.
OIC
E OHIO INJECTOR COMPANY
WADSWORTH, OHIO
Valve Manufacture Since 1883

This Book is Yours.. FREE

Combustion Efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man — the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

Just a Few of Our Hundreds of Friends

International Harvester Co.	20
Armour and Co.	75
Combustion Engineering Company	45
Riley Stoker Corp.	75
Iron Fireman Mfg. Co.	35
Commonwealth Edison Company	145
State of Illinois	85
Cities Service (Oil & Power)	70
and many others	

SEND FOR FREE BOOK

The coupon below will bring you, without expense, full particulars regarding the Hays short, practical, easy reading, home study Course in Combustion. Do your part by starting now to train yourself in the uncrowded wide open field of Fuel and Combustion Engineering. Hays trained men are in demand, today more than ever. Send the coupon Now. No obligation of course.

Hays Institute of Combustion
430 N. MICHIGAN AVE., CHICAGO, ILL.
DEPT. 13

Our 26th Continuous Year . . .

Hays Institute of Combustion,
430 N. Michigan Ave., Chicago—Dept. 13

Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

Name .....

Address .....

City ..... State .....

Company Name .....

R/M PACKINGS Stop Leaks with "They Shall Not Pass!"

IN that other World War, four little words crystallized the determination of an embattled France . . . stopped a ruthless invader at Verdun. Leaks in steam lines, oil lines, fuel lines, and air lines are ruthless invaders, too. R/M packings are equally determined that *they* shall not pass.

With the country geared up for the greatest production in all history, pressures are terrific. They call for better packings to "hold that line" . . . and R/M is the line of packings to hold it. R/M engineers *lose* sleep in order that R/M packings may *gain* in efficiency under today's stiffer demands. These packings don't "take French leave" when they're needed.

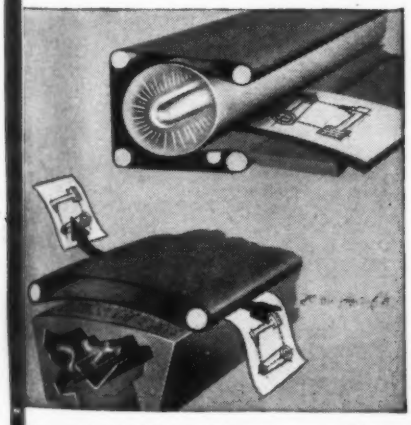
Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy from your R/M distributor, or write us direct.

Awarded to R/M North Charleston Plant.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

THINK WHAT OZALID WHITEPRINTS ARE SAVING US

Thousands of manufacturers using the Ozalid Process point to "everyday" savings in time, labor, and materials—savings which are doubly appreciated when you're rushing supplies to our armed forces.



TIME An Ozalid machine turns out whiteprints of engineering drawings, charts, letters, in two quick steps—Exposure and Dry Development. There's no washing, drying, fixing . . . no cumbersome equipment with a hundred "breakdown" possibilities. Ozalid transparent prints—which may be used in place of valuable original tracings—are produced the same way. No "time outs," as in blueprinting, to change solutions...to rethread the machine.

LABOR Any inexperienced person can be quickly taught to operate an Ozalid whiteprint machine at top efficiency . . . there's never a "labor" problem.

And when draftsmen have to make changes in the design of drawings, precious man-hours can be saved because it's never necessary to redraw any part which remains the same as in the original.

MATERIALS Cut sheets as well as roll stock can be accommodated in an Ozalid whiteprint machine. Thus, by using sheets which correspond in size to your originals, you can completely eliminate trimming waste.

Further conservation is possible because no paper is lost pasting up "leaders." Nor are any Ozalid whiteprints unusable due to distortion.

WRITE FOR SIMPLIFIED PRINTMAKING

Our illustrated booklet explains the Ozalid Process and contains samples of Ozalid whiteprints with black, blue, maroon, and sepia lines on white background.

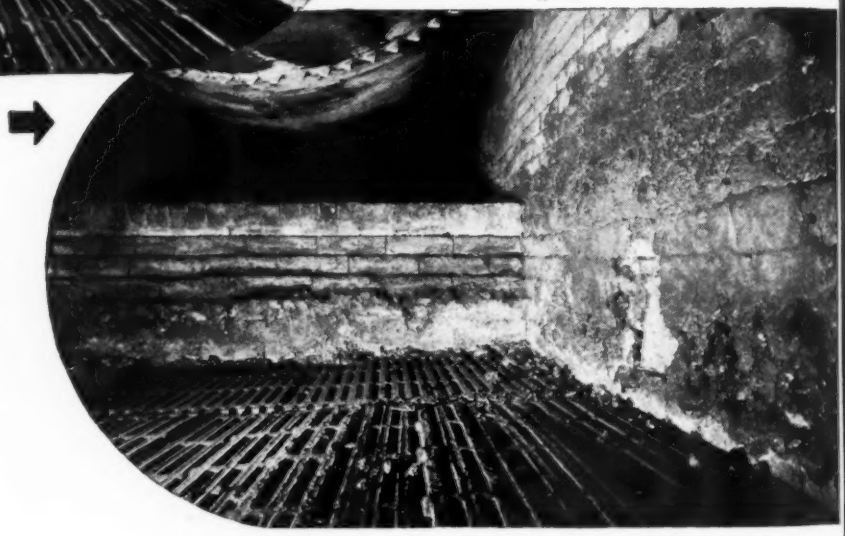
Ozalid Products Division

GENERAL ANILINE & FILM CORPORATION

Johnson City, N. Y.

WHAT *a Whale of a Difference* A GOOD BRICK *Makes*

Crystolon Bricks — after three years' service—are still in A-1 condition, good for many more years of uninterrupted service.



Ordinary bricks — after three years in the adjacent heating boiler—are in very poor condition, will cause a troublesome "shutdown".

***Crystolon* Bricks are particularly resistant to high temperatures and to the chemical action of molten slag. Because of exceptional density they resist the penetration of molten ash. Their ruggedness enables *Crystolon* Bricks to resist the abrasive action of ash and the motion of the fire bed in stoker-fired furnaces.**

R-816

NORTON COMPANY-Worcester, Mass.

NORTON ELECTRIC FURNACE FUSED REFRACTORIES

More Steam with XZIT

FIRE SCALE and SOOT ERADICATOR

Effective regardless of type of boiler or fuel used . . .

●

Have you overlooked the benefits of XZIT? An easy to use, scientific chemical compound, that frees imprisoned power . . . that steps-up operating efficiency! XZIT not only provides a simple, sure method of removing soot and fire scale from boiler heating surfaces, uptakes, breechings and stacks, it discourages any further formation of carbon deposits . . . *XZIT IS APPLIED WHILE YOUR BOILERS OPERATE!*

INVESTIGATE TODAY

Write for complete information concerning the advantages of using XZIT.

XZIT SALES CO.
1031 CLINTON STREET
HOBOKEN, NEW JERSEY

An Important Message to

Technical Men

The war has carried the manufacturing age to a new peak! Production demands have created technical problems the like of which the world has never seen before! The services of engineers are at a premium. Especially the services of one particular class—executive engineers—*engineers with business training;* engineers who can "run the show."

In these critical times, the nation needs engineers of executive ability *now, today* —not five, or ten years from now! The shortage of such men is acute—even more acute than that of skilled production workers. And company heads, aware of this situation, are offering high rewards to engineers who have the necessary training in industrial management.

Golden Opportunity for Engineers

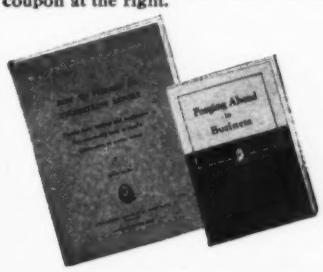
In this new era, the engineer with vision and foresight has a golden opportunity. He will realize that out of today's tremendous production battles will emerge technical men who not only will play a major role in winning the war, but who also will be firmly entrenched in key executive positions when peace comes.

However, before the engineer can take over executive responsibilities, he must acquire knowledge of the other divisions of business—of marketing, accounting and finance. He has of necessity a vast amount of technical training and experience. But in order to grasp the opportunities that present themselves today—to assume leadership on the production front—he must *also* have an understanding of practical business principles and methods.

The Alexander Hamilton Institute's intensive executive training can give you this essential business training to supplement your technical skill.

FREE help for engineers

Ever since the war began, there has been an unusually heavy demand on the part of our technically-trained subscribers for the Institute's special guide on "How to Prepare an Engineering Report". Extra copies of this practical, helpful 72-page Guide are now available and, for a limited time only, will be sent free to all technical men who use the coupon at the right.



134,000 men on the operating side of business have enrolled for this training. More than 37,500 are technical men—engineers, chemists, metallurgists—many of whom are today heads of our huge war industries.

This training appeals to engineers because it gives them access to the thinking and experience of the country's great business minds. It is especially valuable to such men because it is basic, not specialized—broad in scope, providing a thorough groundwork in the fundamentals underlying *all* business. It covers the principles that every top executive must understand. It applies to all types of industrial organizations, because all types of organizations are based on these same fundamentals.

Business and Industrial Leaders Contribute

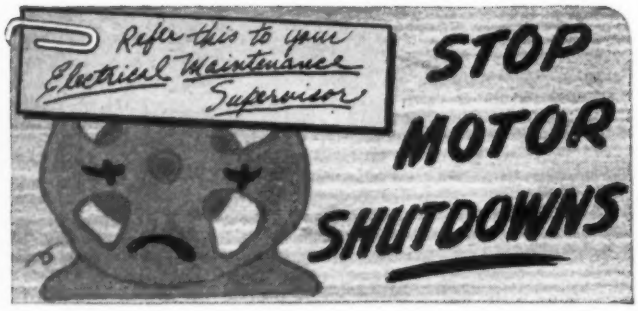
The Institute's training plan has the endorsement of leading industrialists and business men. And it is only because these high-ranking executives recognize its value and give their cooperation that such a plan is possible. Among those who contribute to the Course are such men as Frederick W. Pickard, Vice President and Director, E. I. DuPont de Nemours & Co.; Thomas J. Watson, President, International Business Machines Corp.; James D. Mooney, President, General Motors Overseas Corp.; Clifton Slusser, Vice President, Goodyear Tire and Rubber Co. and Colby M. Chester, Chairman of the Board, General Foods Corp.

Send for "FORGING AHEAD IN BUSINESS"

The facts about the Institute's plan and what it can do for you are printed in the 64-page book, "Forging Ahead in Business". This book in its own right is well worth your reading. It might almost be called a handbook of business training. It is a book you will be glad to have in your library, and it will be sent to you without cost. Simply fill in and mail the attached coupon *today.*

Alexander Hamilton Institute, Inc.
75 West 23rd Street, New York, N. Y.
In Canada, 54 Wellington St., West, Toronto Ont.
Please mail me a copy of the 64-page book—"FORGING AHEAD IN BUSINESS" and also a copy of "HOW TO PREPARE AN ENGINEERING REPORT," both without cost.

Name.....
Business Address.....
.....
Position.....
Home Address.....



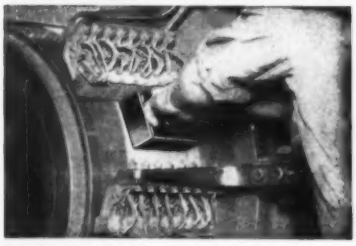
It's not necessary to disassemble motors for smoothing up or truing up worn Commutators or Slip Rings —or for cutting down high mica. You can do the necessary work—right on the motor—and quick—with the IDEAL Resurfacers, Grinders and Undercutters shown below.

IDEAL Commutator Cleaning Stone

Quickly Removes Excess Film

A few seconds' application periodically, cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes and increase brush life. 5 sizes.

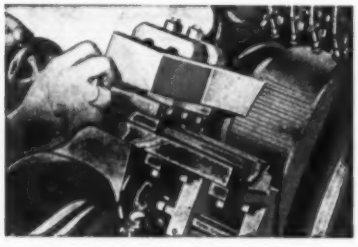
IDEAL Resurfacers



Keep Motors On the Job, WITHOUT DISMANTLING

Quick, easy way to periodically smooth up Commutator and Slip Rings. Eliminates ridges, grooves, pits, high mica. Refinish to a smooth, highly polished surface. No dismantling; no production delays. Over 175 styles and sizes.

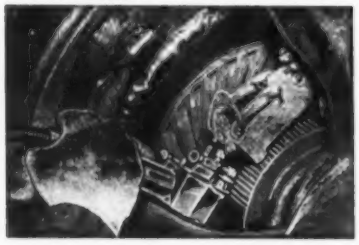
IDEAL Precision Grinders



True Up Commutators and Slip Rings In Own Bearings

If Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore to original efficiency, WITHOUT DISMANTLING. Mount directly on motor frame; grinding is done at normal operating speeds. 3 models.

IDEAL Mica Undercutters



For Undercutting High Mica

Three Models: (1) "Direct Drive", for small commutators. (2) "Universal", for small and medium size commutators. (3) "Shop Model", for large commutators.

Write for Literature on Complete Motor Maintenance Line

IDEAL COMMUTATOR DRESSER CO.
1025 Park Avenue Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd. Montreal, Quebec

Designs for the Future

will include All-Metal Thermometers

More and more, designers of tomorrow's products are incorporating WESTON *all-metal thermometers* in their specifications because of the many advantages these thermometers provide.

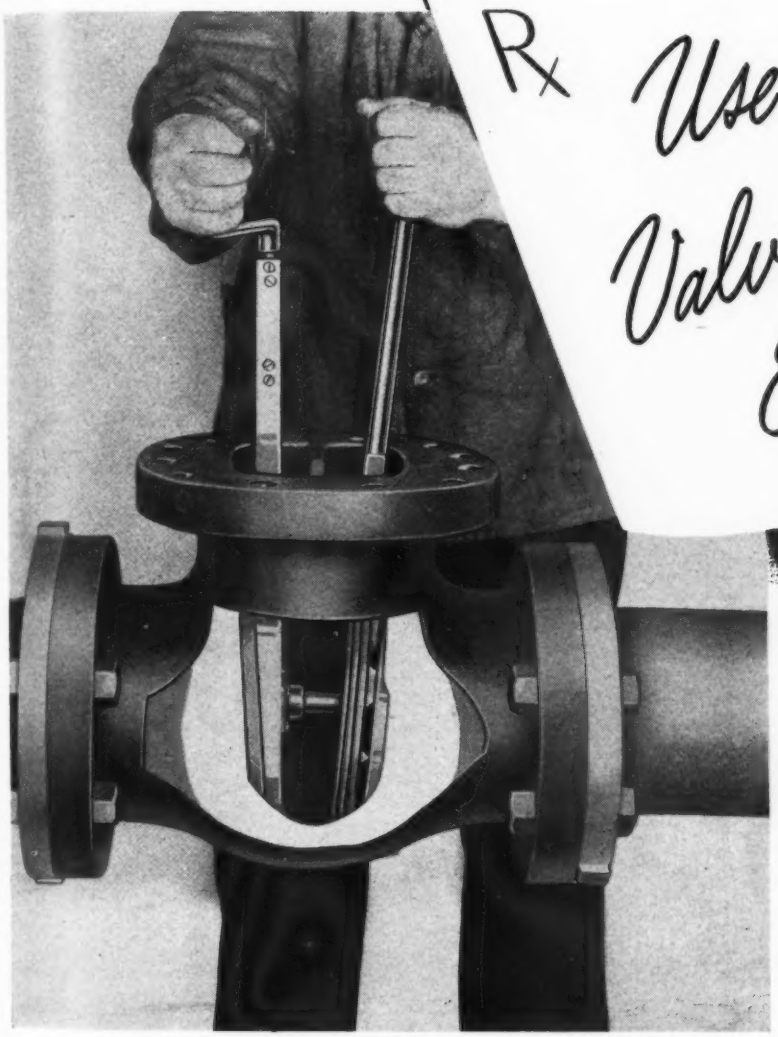
For critical temperature requirements, its *1% full scale accuracy,* and its ability to maintain that accuracy over longer periods, are most appealing. This *long-term* accuracy is made possible by WESTON'S simplified, all-metal thermometer construction. There is no gas nor liquids employed... no capillary... no involved mechanisms. Simply one moving part, and even that part is made of enduring metal. Thus it withstands vibration and over-ranging, and is self-protected against mechanical abuse. Moreover, it has an attractive, dial-type scale which can be read from a distance... *easily and accurately!*

What appeals to designers of *all* types of equipment and appliances, however, is the fact that the physical form of this thermometer lends itself so readily to problems of design. It can be designed *into* a product, rather than made an accessory thereto.

While sales of WESTON all-metal thermometers are at present limited to essential requirements, descriptive bulletin giving complete specifications will gladly be sent to design engineers on request. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *All-Metal* TEMPERATURE GAUGES

Prescription for getting sick valves WELL... and back to work again...



Rx *Use Dexter Valve Reseating Equipment*

Capacities: Globe valves, ¼" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15".

Dexter
VALVE RESEATING EQUIPMENT

Today *every* valve that can do a job — or be *made* to do a job — is needed to help win this war. Valves that are "laid up" *can* be quickly re-conditioned with Dexter Valve Reseating Equipment . . . and sent back to work, as good as new.

With Dexter Valve Reseating Equipment, any mechanic can reseat any make of valve regardless of seat material whether it is made of monel, stainless, stellite, brass, or bronze. Very often the job can be done without removing valves from the line. In any case, when the job is done, seat and gate or disc become pressure tight.

Dexter Valve Reseating Equipment pays for itself *quickly*, often within a few months. Write now for complete information.

THE LEAVITT MACHINE CO., 501 EAST RIVER ST., ORANGE, MASS.

PIPEWRENCH PETE SAYS:

Here's NEWS about

CONTINUOUS BLOW DOWN

NEW ACCURACY NEW ECONOMY!

NEW ACCURACY!
Visual metering, plus restricted seat.

NEW ECONOMY!
Anum-Metl "X" seat and disc last longer than Anum-Metl!

SHOWN: Strong Type SOCBX Valve. List prices: ½"—$20; ¾"—$24.75; 1"—$31.00 (And well worth it!)

NEWEST MEMBER OF STRONG LINE HAS BEEN SELLING ITSELF!

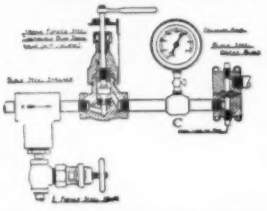
Before this announcement we made sure that Strong's Continuous Blow Down valve had earned its place in Strong's complete line of valves. Developed two years ago, it sold itself—first proved its advantages in important installations, so you can buy it today with confidence!

Its Anum-Metl "X" seat and disc offer almost diamond surface hardness—750 Brinell. For less severe usage, regular Anum-Metl lasts up to 8 times longer than the long-lived metal it replaced.

Call your distributor or write for Catalog 101-P1 on Strong's full line of valves *for severe service!*

CATALOG 176 Strong boiler feeders and liquid level controls. Features non-liming, Anum-Metl seats and discs.

"VOLUMETERING" HOOK-UP



Combination of valve and fixed orifice results in pressure drop and increase in blowdown volume at C. Gauge shows pressure drop, permitting visual control.

Strong, Carlisle & Hammond Company
1392 West Third Street Cleveland, Ohio

STRONG
STEAM SPECIALTIES

Every phase of electrical maintenance and repair work covered in this Library

5 volumes of practical how-to-do-it information

ELECTRICAL MACHINERY — ANNETT
CONNECTING INDUCTION MOTORS — DUNCAN
CONNECTING AND TESTING DIRECT CURRENT MACHINES — ANNETT AND HOLT
ARMATURE WINDING AND MOTOR REPAIR — BRADFORD
TROUBLES OF ELECTRICAL EQUIPMENT — STAFFORD

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

5 volumes—2042 pages—1721 illustrations

IN these books will be found answers to practically all the repair and winding problems that the electrician will meet in actual practice. The books discuss direct and alternating current windings—repair shop methods for rewinding armatures—commutator connection—the testing of armature windings—the testing of induction motors for faults—practical way of reconnecting induction motors—commutator repairs—correct brush troubles, etc. They tell you how to inspect and repair motor starters and generators—how to diagnose motor and generator troubles—how to figure new windings for old cores on induction motors. You learn about three-wire systems, starting rheostats, transformers and starting polyphase motors, etc. They give you scores of practical methods used by electrical repairmen to solve special problems.

Includes trouble-shooting and repair book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library of Electrical Maintenance and Repair includes Stafford's *Troubles of Electrical Equipment*, a handy book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library helps you to know the why as well as the how of electrical maintenance and repair work, gives you the ability to handle bigger jobs with surety of results.

10 Days' Examination—Easy Monthly Payments

You can secure the use of these five great books on electrical repair work for *ten days' examination*. When you have seen for yourself what these books are and how much they can help you, send us your first remittance. The balance may be paid in monthly installments of $2.00 until the price of the library is paid. Send for the books today. Fill in and mail the On-approval Coupon.

McGRAW-HILL FREE EXAMINATION COUPON

McGRAW-HILL BOOK COMPANY, INC., 330 West 42nd St., New York, N. Y.
Send me the Electrical Maintenance and Repair Library (5 vols.) postpaid for 10 days' examination. Within 10 days of receipt I will send $1.00, and $2.00 monthly until $15.00 is paid, or return the books postpaid.

Name .....

Address .....

City and State .....

Position .....

Company ..... P. 3-43

THIS IS SERVICE!

Carrier Tells You How To Keep Your Equipment at Peak Operating Efficiency for the Duration

To help you enjoy the continued benefits of your air conditioning, refrigeration and heating system Carrier has prepared a 5-Point Service Plan.

Today, in the face of increasing shortages of such equipment, replacement parts and trained service men, this check list is a timely guide to insure peak operating performance.

You will find your Carrier distributor or representative ready to give you expert service whenever it is needed and to cooperate with you in every way to help you keep your equipment operating efficiently and economically.

CARRIER CORPORATION, SYRACUSE, N. Y.

5-Point Service Program

1. Make Maintenance of Equipment the Responsibility of a Capable Employee.
2. Make Regular Monthly Inspection of all Equipment. See that it is Properly Lubricated.
3. Keep Equipment Free of Dust and Dirt and Check Frequently for Refrigerant Leaks.
4. Follow Operating Instructions Furnished with Each Type of Equipment.
5. Have Nearest Carrier Distributor Inspect Installation to Insure Satisfactory Operation and Avoid Expensive Repairs.

Carrier

ARMY E NAVY

AIR CONDITIONING • REFRIGERATION

CARRIER CORPORATION
Desk 53-C
Syracuse, N. Y.

Please send free copy of booklet: "Civilian Conservation of the B. T. U." telling how to keep air conditioning and refrigeration equipment operating for the duration.

Name.....

Company.....

Address..... City.....

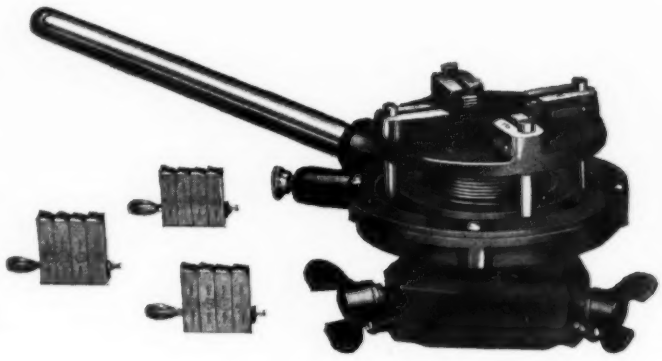
SORRY—

—WE CANNOT DISCUSS DESTINATIONS OF "TOLEDOS"

—or their purpose today but Hitler, Mussolini, Hirohito and Co. will find out—much to their sorrow.

All of the "TOLEDO" Stocks and Dies, Power Pipe Machine, Pipe Vises, Pipe Reamers, etc., being manufactured today are going to war.

After the war is over we will again be in position to serve our many thousands of civilian customers again as in the past.



TOLEDO NO. 1BR 1 TO 2 INCH
RATCHET PIPE THREADER

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO, OHIO — **NEW YORK OFFICE, No. 2 RECTOR STREET**

"TOLEDO"
TRADE-MARK REGISTERED U.S. PAT. OFFICE

MAKERS OF FINE PIPE TOOLS — FOR MORE THAN 40 YEARS

WANTED
DEVELOPMENT ENGINEER

We have an attractive opening for a design engineer familiar with control valves, steam specialties, and industrial instruments.

He will be engaged in vital war work now with prospect of permanent position of great future promise.

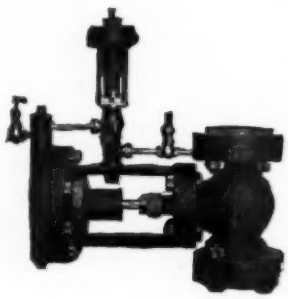
He should be a graduate engineer with several years' actual experience in the design and manufacture of high grade valves for pressure, temperature, level and flow control, and related devices.

Application with detailed information on qualifications and requirements must be by letter headed "Development Engineer" and addressed to W. L. Towne, 10 East 40th Street, New York, N. Y.

SARCO SAVES STEAM
SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

Squires CLASS E PUMP GOVERNOR

Is simple in construction and fulfils all conditions required of a pump governor. Real service is expected from every cash outlay for mechanical equipment, and Squires Steam Specialties are a receipt in full for such investments. It's worth your while to inquire about them.

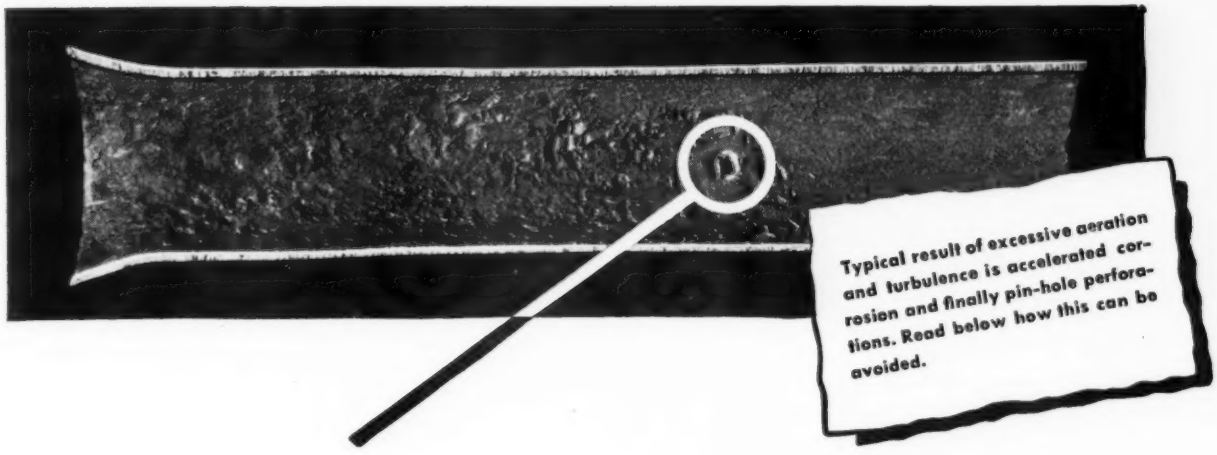


Squires
Class E
Pump
Governor

Described in Catalogue A-11. Sent upon request

The C. E. Squires Company
East 40th St. and Kelley Ave., Cleveland, Ohio

No. 2—how to prolong condenser tube life


Typical result of excessive aeration and turbulence is accelerated corrosion and finally pin-hole perforations. Read below how this can be avoided.

THIS HOLE, CAUSED BY EXCESSIVE AERATION AND TURBULENCE, COULD HAVE BEEN AVOIDED

Finely divided air bubbles increase corrosion and the effect of turbulence. Worn packing on the pumps allows leakage of air into the water. The water level in the intake canal may be so little above the level of the suction pipe end that eddies form around the pipe and large quantities of air will be intermittently drawn into it. If the water is saturated with dissolved air, differences in pressure in the pump itself may liberate the air which has no chance to redissolve before passing into the tubes. In some places a long intake canal into a shallow tidal basin is impractical and in such cases the water may be pumped twice, once into a supply or surge tank on shore, then to the condenser in the usual way. If the surge tank is small the water pumped into it may be white with entrained air. If such water is circulated to the condenser, corrosion will certainly be rapid. The surge tank should be large enough so that baffles can be placed in it to quiet the water and allow the air to escape before it is pumped to the condenser.

The location of the sea chest on a ship, its size and the construction of the strainer have a marked effect upon turbulence which produces entrained air. Tube life can often be improved by increasing the size of the sea chest, by using a louvre type screen, with slats placed lengthwise to the water flow instead of a woven wire screen. Sharp edges of double plates can be filleted by welding to reduce turbulence. Even after all practical precautions have been taken there may be some air in the water.

If the water inlet of the condenser box is too narrow there may be great differences in water velocity due to eddies. Entrained air will collect in the quietest water, then pass through the tubes to cause failures in definite locations. If the condenser is a "double pass" with a horizontal web in the center, it will often help to drill a few holes in the web where pockets of air collect, thus by-passing some of the water and most of the air to the outlet water box.

A request on your letterhead for more complete information on the prolongation of condenser tube life will receive prompt attention. 4392

ANACONDA

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Company. In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

BROWNELL BOILERS

For 85 years this company has been making good boilers. We invite comparison on quality, price, and delivery of various types and sizes of fire tube boilers from 3 H. P. to 250 H. P.

Write us for illustrated bulletins.

THE BROWNELL COMPANY — The World Over — DAYTON, OHIO, U.S.A.

WHERE TO BUY

Featuring additional products and specialties for power plants

Again burning coal? Well, DON'T take on the old time expense and troubles of

SLAG DAMAGE

Armor-Clad distinctive coatings provide low cost, unparalleled protection and increased life to refractories in coal or oil fired furnaces, especially to:

Electric furnace linings;
Arches and baffles;
Impingement areas;
Pulverized coal and oil burner rings.

An interesting circular "Keep America's Furnaces on the Firing Line" will be sent upon request.

ARMOR-CLAD COMPANY
39 Hyatt Ave. Newark, N. J.
Emil A. Schroth, Pres.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

A Good Habit

This Where To Buy Section supplements other advertising in this issue with additional announcements of products and materials of special interest and application in the power generation and transmission field. Make a habit of checking this page each issue.

PROFESSIONAL SERVICES

ACME METER SERVICE CO.
—Utility Engineering—
Detecting wastes in Electricity, Gas, Fuel and Water, thus stopping losses, and frequently increasing production — nominal fee.
11 West 42nd Street New York, N. Y.

COLUMBIA ENGINEERING CORP.
STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports
61 Broadway New York, N. Y.
323 Plum Street Cincinnati, Ohio

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plant Surveys Appraisals Reports
1316 Arch Street Philadelphia, Pa.

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports — Examinations — Laboratory
Industrials and Utilities
61 Broadway New York
Reading, Pa.
National Press Bldg. Washington, D. C.

HALL LABORATORIES, Inc.
R. E. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

LANCASTER, ALLWINE & ROMMEL
Patents—Copyrights—Trade Marks
Booklets—General Information Concerning Inventions & Patents and "Free Schedule" sent without obligation.
Established 1915
Suite 456, 815—15th St., N.W., Washington, D. C.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

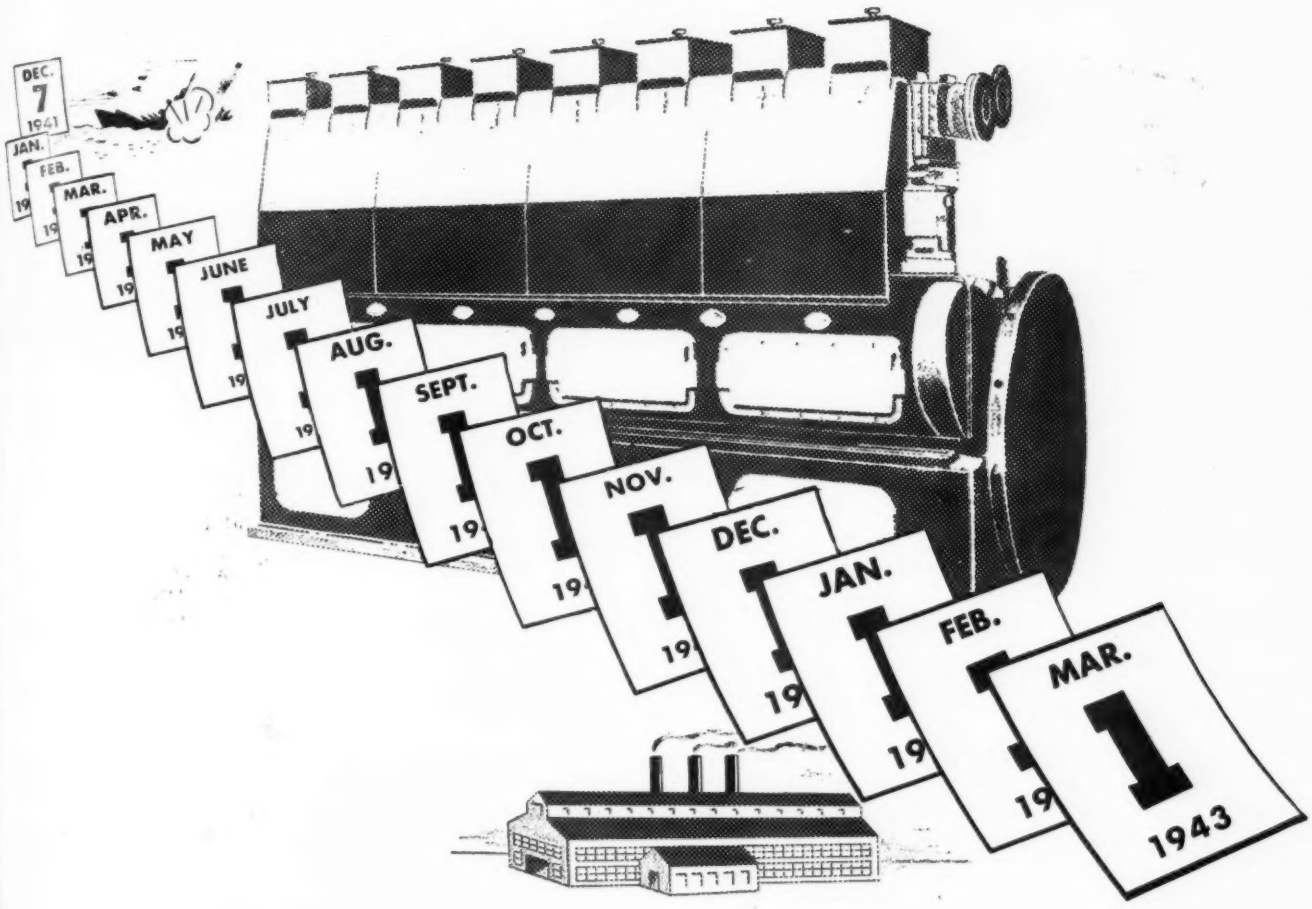
J. E. SIRRINE & COMPANY
Power Plants — *Engineers* — Consultation
Design — Reports
Water — Steam Utilization — Plans
Greenville South Carolina

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS—CONSTRUCTORS
New York, N. Y.



IT'S MUCH LATER THAN YOU THINK!

Here's something for every Diesel Operator to act on—NOW!

It already is more than a year since Pearl Harbor. For the Nation's Diesel equipment, that has meant more than a year of steady, hard driving—to meet the needs of all-out, non-stop war production.

Many Diesel machines already are beginning to show signs of strain. And with quotas still mounting, with less time for overhauls, and with replacements getting scarcer — the chances for machine breakdown are increased a hundredfold.

Under the circumstances, it's only good horse-sense to protect your overworked Diesel with the *right* lubricants. The stakes are too high, the times too critical, to muddle along with ordinary, run-of-the-mill oils and greases. For the plain fact is that *continuous, efficient operation demands lubricants planned especially for your particular job!*

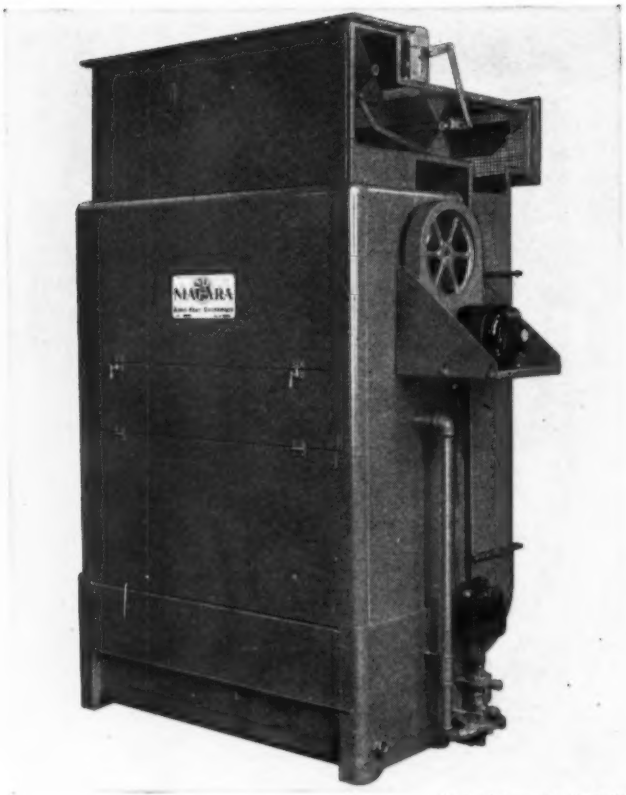
This is a problem with which Cities Service has had long and successful experience. Whether your work calls for one or many types of lubricants—Cities Service is ready to serve you with top-quality products and expert engineering counsel.

It's much later than you think. Get in touch with your nearest Cities Service office — today!

An up-to-the-minute booklet on "Diesel Engine Lubrication" will be sent, upon request, to Diesel operators—Write to Cities Service Oil Co., Room 1337, Sixty Wall Tower, New York, N. Y.

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.



U. S. Patent No. 2,296,916

NIAGARA
AERO HEAT EXCHANGER
Eliminates Refrigeration, Saves Water, Cuts Power Cost

● Expensive refrigeration is usually unnecessary in industrial cooling. The Niagara Aero Heat Exchanger, employing the evaporative principle, provides cooling with only negligible water consumption. It has been applied successfully in cooling machinery and process jacket water, oil or water quenching baths, lubricating oils or compounds, gases or chemicals.

It provides a closed system free from contamination. Ideal temperature conditions are assured by patented Niagara temperature controls. In installation, both expense and space are saved. Operating costs, as proved by experience, are low because pumping, piping and power are saved.

Write for Niagara Bulletins 90 and 94—and information on users' experiences. Address Dept. P-33

NIAGARA BLOWER COMPANY
General Sales Office: 6 E. 45th Street, New York City

461 Statler Office Bldg., Boston
673 Ontario St., Buffalo
37 W. Van Buren St., Chicago
648 Hanna Bldg., Cleveland
2832 E. Grand Blvd., Detroit
Room 1222, Commercial Trust Bldg., Philadelphia
Fourth & Cherry Bldg., Seattle

District Engineers in Principal Cities

NIAGARA

INDUSTRIAL COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

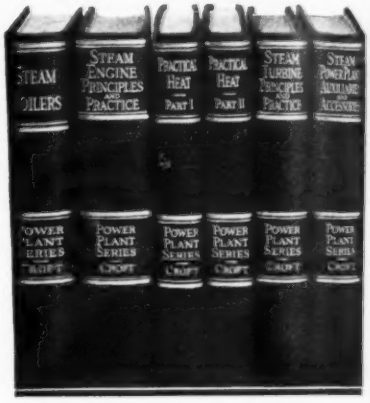
It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)



The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

No books dealing with the work of the power plant man were ever so complete — so authoritative — so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a **Power Plant Library** FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers **Power Plant Practice.** Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10-days' examination. If you decide to keep the books after examining them, just send $2.00 and then $2.00 a month until the total low price of $16.00 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL FREE EXAMINATION COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., New York

Ship to me, charges prepaid, the six volumes of the Library of **Power Plant Practice.** If satisfactory, I will send $2.00 in ten days and $2.00 a month until the price of $16.00 has been paid. If not wanted I will return the set to you postpaid. (To insure prompt shipment write plainly and fill in all lines.)

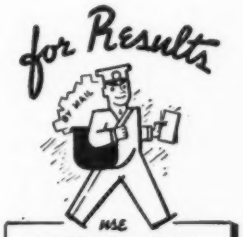
Name .....

Home Address .....

City and State .....

Firm or Employer .....

Position ..... P. 3-43



MAILING LISTS THAT WORK...

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

McGraw-Hill Publishing Co., Inc.

DIRECT MAIL DIVISION

330 WEST 42nd STREET
NEW YORK, N. Y.

RUN YOUR UNDERGROUND STEAM AND HOT WATER LINES IN

ADSCO BANNON TILE CONDUIT

The metal that would be required if all underground steam and hot water lines installed this year were run in metal conduit, would build a surprising number of tanks and guns.

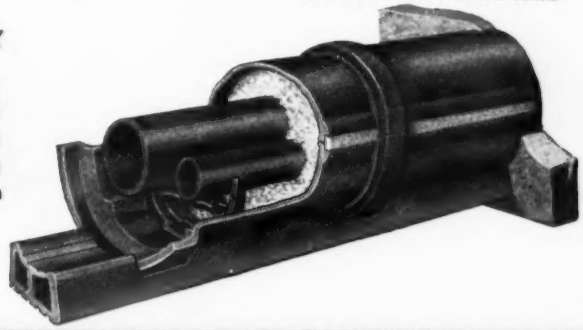
This is why ADSCO-Bannon Tile Conduit is America's No. 1 wartime conduit.

With the exception of a very small amount of metal used in pipe supports and rollers, ADSCO-Bannon Conduit is made of non-critical materials — Vitrified Clay Tile — fiberglas insulation.

Also, in ADSCO-Bannon Tile Conduit, a specially designed tile base drain provides adequate drainage for the underground lines. This prevents flooding of the conduit, thereby maintaining its thermal efficiency. Easily installed with a minimum of labor —makes a permanent installation.

Submit details of proposed installation for prompt quotation or write for illustrated bulletin No. 35-67PR.

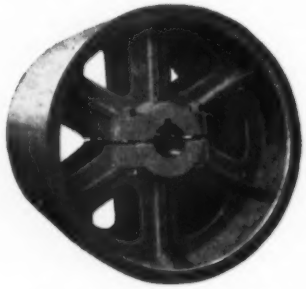
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA N.Y.
MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS



BASE DRAIN.... PREVENTS WATER SEEPAGE FROM FLOODING CONDUIT

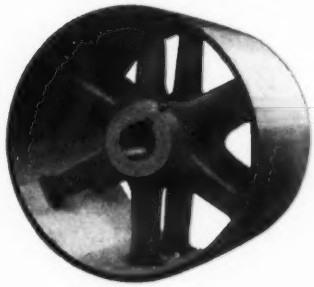
High test cast iron pulleys in all sizes and types

Completely split pulley



Extra heavy conveyor pulley

Single arm solid pulley



Double arm pulley

JONES cast iron pulleys are true running — they permit higher speeds — no bushings and they can't fall apart — they don't rattle and they look better on most machines.

These pulleys are machine molded, poured of high test cast iron, and are accurately finished and balanced. Multiple piece pulleys, rubber covered pulleys and flywheels can be furnished.

W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago, Illinois

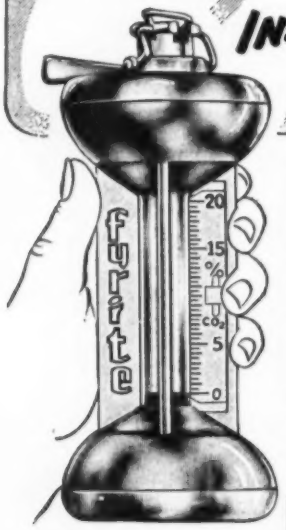
Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS • PULLEYS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

VICTORY ... DEPENDS ON UTMOST FUEL UTILIZATION

PORTABLE FYRITE "ORSAT" CO_2 Analyzer

INSTANTLY EXPOSES FUEL WASTE!



Makes ACCURATE Flue Gas Tests EASY

America's all-out war effort demands utmost fuel conservation. The FYRITE "Orsat" CO_2 Analyzer is an amazingly simplified and practical aid in cutting stack losses. The FYRITE makes flue gas tests easy. It is conveniently held in the hand while analysis is taken; accurate within ½ of 1% CO_2; spillproof; cold-proof; rugged, durable, compact. More than 7000 in use.

RETURN COUPON BELOW. *Obtain new bulletin on FYRITE and learn how to get immediate delivery under priority regulations.*

$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH, PA.

SEND BUL. 338 on *FYRITE "ORSAT"*

Name

Address

City State P

Use The NEW Way to WELD Pipe WITH

WEDGE Split CHILL RINGS

New and better methods are constantly coming to the front. A new development in chill rings will save you labor, time, welding material and give you a STRONGER joint. See unretouched photos below. Are WEDGE Chill Rings with the patented SPLIT Feature expensive? NO! They are cheap and will pay their cost from savings in labor, material and time.

100% *penetration*

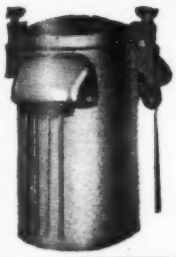
50% *penetration*

Write for Circular and Prices

WEDGE PROTECTORS, INC.
9524 Richmond Ave. Cleveland, Ohio

WEDGE CHILL RINGS SAVE MONEY

-TRANSFORMERS-



TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

BOILERS WANTED

Two Scotch Marine or Locomotive Type Boilers approximately 175-350 BHP. Capacity each 125 lbs. per square inch working pressure. Hand or stoker fired for immediate delivery.

LIEBMANN BREWERIES, INC.
36 Forrest Street
BROOKLYN, NEW YORK

POSITIONS VACANT

WANTED Direct Factory Representative. Well established N. Y. City manufacturer of alkali cleaning compounds, laboratory equipped, requires man with special knowledge of Boiler Feed Water treatment, to sell tested Boiler Compound to industrial plants. Unrestricted territory, liberal commission with drawing account paid weekly. Please state qualifications. P-513, Power, 330 W. 42nd St., New York, N. Y.

MACHINERY INSURANCE INSPECTOR wanted for territory adjacent New York, familiar with steam turbines and engines, diesels, and electrical power apparatus, considerable travelling required. Give full particulars, education and experience. P-514, Power, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertisement service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

REPRESENTATIVE WANTED

SALES REPRESENTATIVES WANTED For substantial repeat order business in boiler room and heat treating fields. Experience desirable. Liberal commission. Whole or part time. Protected territory. Write Brickseal Refractory Co., 1031 Clinton St., Hoboken, N. J.

LINES WANTED

by

Manufacturer's agent with 6,000 sq.ft. warehouse on R.R. siding. Headed up by Mechanical Engineer.

•

Now calling on power houses, refineries, industrial and manufacturing plants, shipyards and aircraft plants, Los Angeles, Calif. metropolitan district. Thoroughly familiar with lines associated with piping, pressure temperature regulation, powerhouse auxiliaries, etc. Desire either mechanical equipment lines or material lines and can provide space for carrying Coast stock.

RA 511 Power
68 Post St. San Francisco, Cal.

WANTED

Experienced man to operate Westinghouse Bleeder Type Turbine and Auxiliaries in Paper Mill. Must be sober and reliable. Good opportunity for the right man.

P 515, Power
330 W. 42nd Street, New York, N. Y.

OPERATING ENGINEERS—WANTED

Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.

Apply
Local No. 33, M. E. B. A.
227 Fulton Street New York City

SALES AGENTS WANTED

An Internationally established line of Separatory Equipment for steam, air and gas, has a few select territories open. Liberal commission. Territories open, Western Pennsylvania, Middle States and Great Lakes area.

AW-512, Power
520 No. Michigan Ave., Chicago, Ill.

MOTOR REWINDS?

ARE YOU PARTICULAR?
DO YOU HAVE A SPECIAL MOTOR?
We stock only the Best of Insulation
100% Factory Work
TRY US
Previous Experience with
General Electric Allis Chalmers
Westinghouse Navy Yard Work

C. V. HUNT
Est. 1916
Ridgefield, N. J. Morsemere 6-5091
Trucks #1—U.S. Highway and Erie Railroad

W. L. SULLIVAN
*** MECHANICAL ENGINEERING ***
Also furnishing power plants, industrial, municipal and private, plants, designed, appraised or built, complete or parts, steam or other fuels, boilers, engines, pumps, machine and manufacturing plants also, new or used equipment.
P. O. BOX 236
Oklahoma City Oklahoma

WANTED

300 H.P. Squirrel Cage Motor, 3 phase, 50 cycles, 440 Volts, 360 r.p.m. in good condition.

CEMENTO DE MIXCOAC, S. A.
Apartado 7 Tacubaya, D. F.
MEXICO

DIESEL ENGINES GENERATORS

Wanted 2500 hp. in one or more units. Will consider generators only. Give full details.

W-506, Power
330 West 42nd St., New York City

WANTED

Diesel Electric Generating Unit

100 to 150 KW. State condition, price, etc.

MAGAZINE LUMBER COMPANY
Bogalusa, La.

STEEL TANKS FOR SALE

220,000 Gal. Cap. 43 Ft. Dia. 20 Ft. High. Riveted Construction.
3—12,000 Gal. & 1—6500 Gal. R.R. Car Tanks.

L. M. STANHOPE
WAYNE PENNA.

1—45" 110 volt Cutler Hammer round magnet, Bare unit. GUARANTEED electrically.
Price $1150.00

1—12 KW. 125 volt Buffalo Marine gasoline engine generator set. Price if purchased with magnet.
GUARANTEED REBUILT $650.00

ELECTRIC EQUIPMENT COMPANY
P. O. Box 51 Rochester, N. Y.

BOILERS

(Straight tube type)
Forced draft chain grate stokers
4—500 HP 200#.
2—350 HP 175# Heine type
Immediate delivery.

Woodworth Engineering Company
705 Olive Street St. Louis

DIESEL ENGINES

Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries —also boilers, steam engines, turbo generators.

Complete information on request.

A. G. SCHOONMAKER COMPANY
50 Church St. Phone—Worth 2-0455 New York, N. Y.

FOR SALE

General Motors, 6 cylinder, 90 H.P. Diesel Engine, and Worthington Pump radial, air cooled, two stage, air compressor, 387 cubic feet of air. First-class condition. New Sept. 1939.

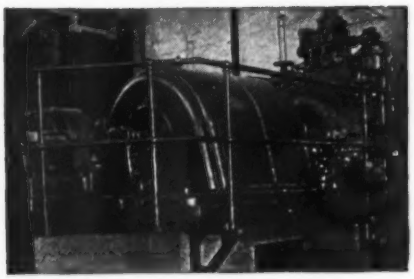
FS-516, Power
330 W 42 St., New York City

FOR SALE

Ingersoll Rand Imperial Type 10 Two Stage Air Compressor with A.C. Motor, Automatic Starter and Tank.

SHANK-COBLEY, INC.
1017 Madison Ave. Toledo, Ohio

FIRST AID TO THE PLANT THAT NEEDS POWER FOR PRODUCTION!



MOTORS GENERATOR SETS

1—200 KW, 600 volt, GE, sq. cg.
2—250 KW, 250 v., GE Synch.
2—200 KW, 125 v., Wsgh., Sq. Cage.
1—100 KW, 125 v., GE Sq. Cage.
1—100 KW, 125 volt, Electric Products, syn.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volts, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—400 HP, 514 RPM, 440 volt, Westg, slip ring.
1—335 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL, Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westinghouse, 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM,G.E., type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E., 625 RPM, Type DLC-65, Form A.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E. 625 RPM, Type C.
1—25 HP, Westinghouse, 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-12, Form A.
2—20 HP, Westinghouse, 1700 RPM, Type SK.
1—15 HP, G.E., 800 RPM, Type RC-11.

SPECIAL

Rotary converter, General Electric, 3120/4030 kw, 167 rpm, 25 cycle, 240/300 volt, 13,000 amperes. Booster type. Condition like new.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

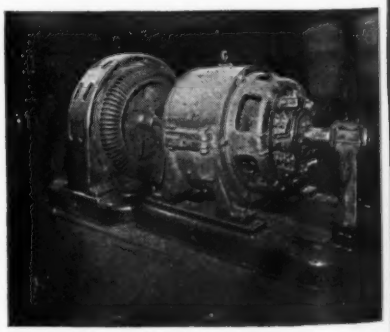
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 1500 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



POWER EQUIPMENT FOR FIGHTING EQUIPMENT

HEMPHILL

J L HEMPHILL & CO..1602 53rd ST NORTH BERGEN N.J.

★ ★ *Phone* **New York — Longacre 5-3227** **New Jersey — Union 3-2600** ★ ★

ELECTRICAL POWER EQUIPMENT

ROTARY CONVERTERS

3 Phase 60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 13200 volt transformers.

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 2300/4000-6900/12000 volt transformers.

750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 2300/4000 volt transformers.

ROTARY CONVERTER

3 Phase 25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformers.

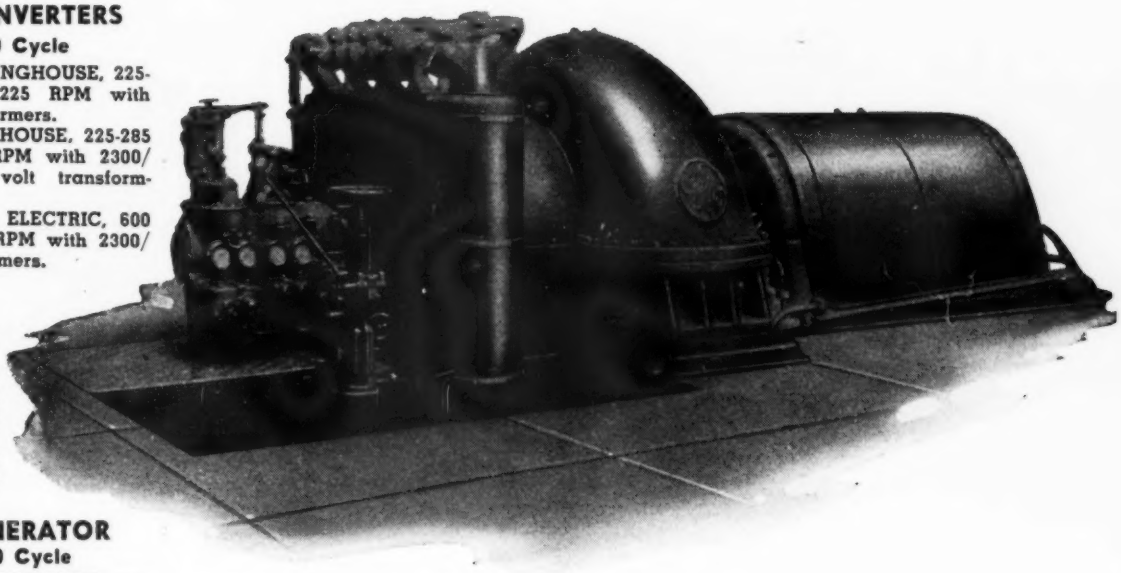
TURBO GENERATOR

3 Phase 60 Cycle

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps.



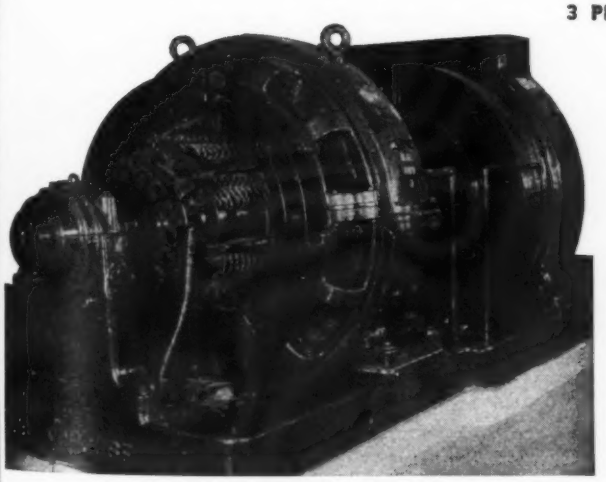
Actual Photograph

3125 KVA GENERAL ELECTRIC CONDENSING TURBO UNIT

3125 KVA General Electric Alternating current generator, 3 phase 60 cycle 2400/4160 volts 3600 RPM direct connected to General Electric condensing turbine 225-400 lbs. steam pressure 700 deg. TT. Equipped with surface condenser and auxiliaries.

MOTOR GENERATOR SETS

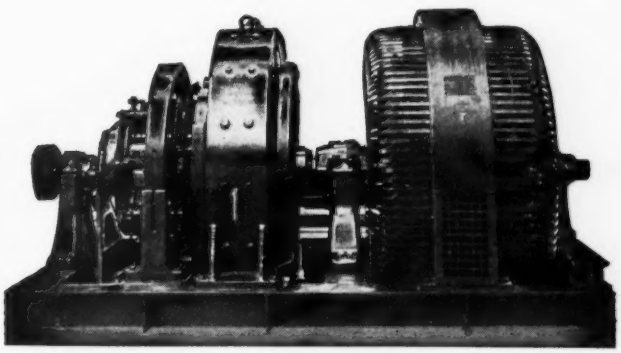
3 Phase 60 Cycle



Actual Photograph

1000 KW WESTINGHOUSE MOTOR GENERATOR SET

1000 KW (1500 KW 2 hrs., 55 deg. C rise) WESTINGHOUSE direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1427 HP 80% P.F. (2140 HP 2 hrs. 55 deg. C rise) WESTINGHOUSE synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD — CLEVELAND, OHIO

STOCK EQUIPMENT ON HAND for YOUR NEEDS

AT
43 HOWELL ST.
JERSEY CITY, N. J.

SHIPMENT AS FAST AS CONDITIONS ALLOW.

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 600 V. D.C. to 2100 H.P. 6600 V.

1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.

1—500 KW G.E., 600 V. D.C. to 700 H.P. 2200 V.

2—250 KW G.E., 250 V. D.C. to 375 H.P. 2200 V.

1—150 KW G.E., 250 V. D.C. to 200 KVA, 440 V.

1—150 KW G.E., 575 V. D.C. to 225 H.P. 2300/4000 V.

1—125 KW WHSE., 250 V. D.C. to 200 H.P. sq. cg., 440 V.

1—100 KW WHSE., 250 V. D.C. to 150 KVA, 2300 V.

1—100 KW WHSE., 250 V. D.C. to 175 H.P. sl. rg., 2200 V.

1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.

2—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.

1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.

ROTARY CONVERTERS

Primary 3 Phase 60 Cycle

1—1500 KW WHSE., 720 R.P.M., D.C. 600 V. A.C. 26400/13200 V.

1—1500 KW WHSE., 600 R.P.M., D.C. 600 V., A.C. 11500/10360 V.

1—1250 KW G.E., HCC, 720 R.P.M. D.C. 250 V., A.C. 2300 V.

1—1000 KW WHSE., 900 R.P.M., D.C. 600 V., A.C. 11000/2300 V.

2—750 KW WHSE., 1200 R.P.M., D.C. 600 V. A.C. 5500/2300 V.

1—750 KW WHSE., 720 R.P.M., D.C. 250 V., A.C. 6600/2200 V.

1—500 KW WHSE., 900 R.P.M., D.C. 250 V., A.C. 6600/2200 V.

1—500 KW WHSE., 1200 R.P.M., D.C. 600 V., A.C. 2300 V.

3—375 KW WHSE., 1200 R.P.M., D.C. 250 V., A.C. 6600/2200 V.

3—300 KW G.E., HCC, 1200 R.P.M., D.C. 600 V. A.C. 2300 V.

ROTARY CONVERTERS

3 Phase, 25 Cycle

Booster Type

2—1500 KW G.E., HCC, 500 RPM., D.C. 225/275 V., 6000 Amp., A.C., 13200/6600 V.

1—500 KW G.E., HCC, 750 RPM., D.C. 225/275 V., 2000 Amp., A.C. 6600 V.

TURBO GENERATOR SETS

1500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.

1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with Curtis 4-stage 150 lb. cond. turbine with cond. and access.

1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. bk. pres., 2000 RPM.

A. C. MOTORS

3 Phase—60 Cycle
SLIP RING

HP	Make	Type	Volts	Speed
2—1200	Cr. Wh	801Q	2300	257
1— 800	Al. Ch.	ANY	440	885
1— 600	G.E.	IM	2200	900
1— 500	G.E.	IM	440	392
1— 450	Whse.	HW.	2200	875
1— 400	Al. Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	Whse.	CW	2300	600
1— 250	G.E.	MT	4000/2300	257
1— 250	G.E.	MT-410	2300	390
2— 200	Whse.	CW	2200	514
2— 200	G.E.	IE-13B	2200	1750
1— 200	G.E.	IM	440	600
2— 175	G.E.	IE-15A	2200	880
1— 150	Whse.	CW-772	220	1165
1— 150	G.E.	IM	2200	695
1— 150	G.E.	MT-564	440	600
1— 150	G.E.	IM-17B	2200	290
1— 125	G.E.	MTP-547	2200	1750
1— 100	G.E.	IM	220	1750
1— 100	G.E.	MT-5546	220	860

A. C. MOTORS

SQUIRREL GAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	I-17B	2200	690
1—400	Whse.	CS-1104A	2200	885
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al. Ch.		220/440	1150
2—200	Whse.	CS	2300	1200
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
1—200	Whse.	CS	440	580
1—100	Whse.	CS	550	1750
1—100	G.E.	KT-558	440	900

A. C. GENERATORS AND SYNC. MOTORS

3 Phase—60 Cycle

KVA	Make	Type	Volts	Speed
1—750	Whse.		6600	720
1—625	Whse.		480	900
1—500	G.E.	TS	440	360
1—250	G.E.	ATB	2300	600
1—250	G.E.	ATI	220	450
1—150	Whse.		2400	900
1—150	Whse.		4000	1800
1—100	Whse.		2400	900
1—125	G.E.	ATB	240	257
2—100	Whse.		2300	1800
1— 45	Whse.		2300	514

GEAR REDUCTION UNITS

1—2100 H.P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 750 H.P. Al. Ch. 3600/600 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
1—1500	Whse.	3	OISC	26400/13200/440
3—1000	G.E.	1	HKDD	13200x2300
3—1000	Pitts.	1	OISC	2300/4600x575
4— 625	G.E.	1	HJ-DD	2300x445
2— 333	Pitts	1	OISC	2400x220
3— 300	Pitts.	1	OISC	2300x115/230
3— 300	G.E.	1	H	13200x2300/575
2— 200	G.E.	1	HILD	26400x115/460
3— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SK	2200x440/220
3— 150	Whse.	1	SKM	2400x120/240
6— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250
4— 75	Pitts.	1	OISC	2300x575
4— 75	Pitts.	1	OISC	2300x575
3— 75	Whse.	1	SK	6600x440/220
3— 50	Maloney	1	HE	11000x2300
3— 50	G.E.	1	H-KA	13800x115/230
2— 50	Whse.	1	SA	2200x440/220
3—37½	Whse.	1	SK	13200x2300

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
2— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MCF	230	400/1000
6— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC 102H	230	1150
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/825
7— 150	G.E.	RC-19	230	800/1000
2— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO-1832	230	625
3— 120	Whse.	SK	230	720
1— 100	Al. Ch.		230	950/1150
3— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
2— 100	G.E.	RC-19	230	575/720
1— 75	Whse.	SK	230	475 900
1— 75	G.E.	C	230	500/1000
4— 60	Diehl	K-11	230	500/1000
3— 60	Cr. Wh.	CMC-65H	230	500/1000
4— 50	G.E.	RC-16	230	650/815
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
1— 50	G.E.	RC	230	400/1200
1— 50	Whse.	SK-150	230	750/1125
1— 50	El. Dyn.	50S	500	194/775
1— 45	Cr. Wh.	CCM-65H	230	400/800
5— 40	G.E.	RC-31	230	1700
1— 40	G.E.	CD-103	230	1150

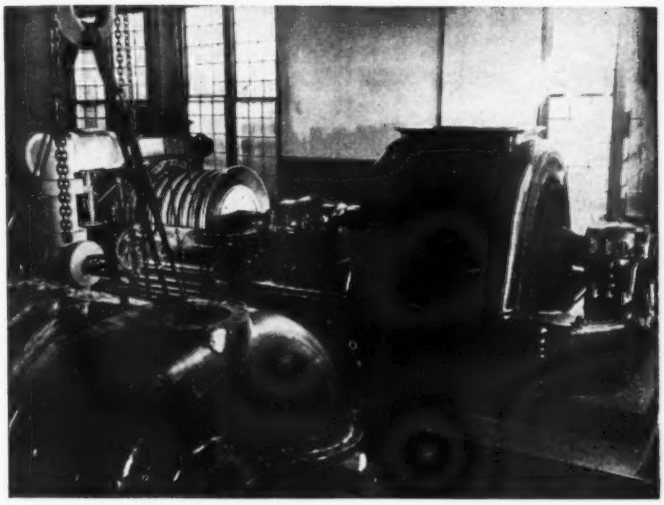
LARGE D.C. AIR CIRCUIT BREAKERS

Amp.	HP	Type	Volts	Pole
1—14000	Anderson		240	2
1—10000	Whse.	CA	250	2
2—10000	G.E.	CK	250	1
4—10000	Whse.	CA	750	1
2— 6000	G.E.	CK	600	1
1— 6000	Whse.	CA	250	1
2— 5000	ITE	LG	250	1

RE NU BILT
BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA
COMPANY INC.
Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.



7500 Kw Condensing Turbo-Alternator

7500 KW 80% Curtis General Electric 6-stage Impulse Pattern Condensing Turbo (in record log service performing at 10/11000 KW.) Unit is 60/3/5000/1800 RPM/200# 150° Superheat (has been operated standardly under 250# ISP). Steel steam chest and throttle valve; generator mica insulated. Standard operating temperature rated 40°C. Wheeler Surface Condenser equipped.

CONDITION: In personal disassembly inspection accompanied by parent experts, recently completed, the fact of quality almost equal to new has been verified.

TURBOS—60 cycles

15000 KW performance 40° Impulse and Reaction Semi-Double Flow Condensing unit with non-automatic bleeder facility, 200# design (approved and adaptable with slight changes for 400# and non-automatic in max. volume at either 100# or 65# GPB (single parallel theory for 2300 volts). Surface Condenser and all auxiliaries complete. "In RANGE".

5000 KW 60/3/2300/3600, 200#, 100° to 625° T.T. General Electric Condensing; installed about 1923, total log service six years, recently released from standby berth. All auxiliaries included—jet condenser equipped.

2000 KW rated Allis-Parsons (approx. 3000 KW normal) 60/3/440, no Condenser (would operate efficiently at approx. rated log NC plan at approx. 18# GP).

2000 KW GE Curtis 4-stage Impulse design 60/3/2300/1800 RPM Condensing and Non-Automatic Bleeder, Surface Condenser equipped. Has log record of 2600 KW constant at 40°. Total log service record 8000 hours (approved non-automatic bleeder theory 30,000# 20# BP. 1800/2000 KW performance.

2000 KW Westinghouse Reaction design 60/3/2300/1800 RPM. Now Barometric Condenser equipped. Officially approved for NC plan at minimum 1500 KW 18# BP. Operators vouch for first-class condition thruout.

A number of smaller units in the range of 300, 500, 750, 1000, 1250, and 1500 KW, in the classifications of low pressure (12#), mixed pressure, and medium and high pressure (350#) condensing and non-condensing, both surface condenser and jet condenser equipped sets are available.

TURBOS—25 cycles

50,000 KW total aggregate capacity—In unit sizes of 3000 to 6000 KW—Complete sets with Surface Condensers—First Class Condition.

SURFACE CONDENSERS

Surface condenser units complete in following general capacity range 20,000 sq. ft., 15,000, 12,000, 11,000 and 8,200 sq. ft. Also other smaller units.

WATER TUBE BOILERS

4—700 HP, 200# ASME box header straight tube, including stacks and all trimmings, auxiliaries, supporting steel, and considerable structural steel from building. Capacity 160,000# per hour total.

2—330# 100,000#/HR units complete.

8—400 HP B&W STIRLING 200# ASME POWDERED COAL FIRED, SUPERHEATERS, SOOT BLOWERS, FORCED DRAFT FANS, FEEDWATER HEATERS, COAL AND ASH HANDLING, METERS, GAUGES, ETC.,—STEEL BUILDING CAPABLE OF DISMANTLING—SHORT LOG SERVICE—200# APPROVED—RECENT INSPECTION.

4—500 HP B&W Sectional Header 180#

4—500 HP B&W Stirling 200# ASME—Pulverizers.

Approximately 12 Smaller Straight Tube and Bent Tube Boilers 200#—350/500 HP.

PIONEER PERSONAL SERVICE COOPERATION IN HEAVY POWER THRU THREE WARS—IN INTEGRITY OF PERFORMANCE

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

4—500 KVA Gen. Elec. Type H form KDD, 60 cy. Single Phase, Primary 6900V or 11950 Y; secondary 2300V—with primary taps—circular coil H design.
6—150 KVA Gen. Elec. type H 2200/220/440 25 cy. single phase.
1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.
1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 rpm with direct connected exciter.
200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM, revolving field.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM, revolving field, built-in exciter.

D. C. GENERATORS

150 KW Western Elec. 3 big, 3 wire, 150/230 V, 600 RPM.
50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

FREQUENCY CHANGERS

All sizes, voltages and cycles.

★400 H. P. SYNCHRONOUS MOTOR★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
300	Gen. Elec.	Sl. Rg.	I Form M	600	220/440
200	Wsghse.	Sl. Rg.	CW	900	220/440
200	Gen. Elec.	Sq. Cg.	I Form K	514	220/440
175	Ideal	Sl. Rg.	AVA	1750	2200
150	Gen. Elec.	Sq. Cg.	I K	600	2300
150	Burke	Sq. Cg.	3 big 2 ph	900	220/440
125	Gen. Elec.	Sq. Cg.	I K	720	220/440

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
200	Wsghse.	Sl. Rg.	CW	485	220/440
200	Gen. Elec.	Sl. Rg.	I Form M	485	220/440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
150	Gen. Elec.	Sl. Rg.	I Form M	750	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CC6	500	220/440
75	Triumph	Aut. Start		750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440

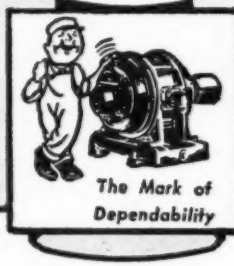
230V DC MOTORS

H.P.	Make	Type	Speed
150	Burke	Comp. Inter.	450/700
105	Gen. Elec.	CL/6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
40	Fair. Morse	Ball big. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

Only partial listing—Write or wire your inquiries

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK



THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

2—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

2—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor Complete.

1—150 kw. Westinghouse 250 v. 600 rpm., dir. con. 2200/3/60 syn. motor.

150 KW Ridgway 250 v. D.C. 900 rpm. dir. con. 2300/3/60 syn. motor, complete

100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.

1—75 kw. G.E. 250 v. 900 rpm., dir. con. 2300/3/60 Syn. Motor.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam.

1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm., dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

CHAIN HOISTS

19—2 Ton Ford Triblock Spur Gear, Complete with 3 Ton Trolleys.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

2—120 kw. G.E. 220/440 v. 3 ph. 60 cy. 900 rpm., 80% P.F.

GAS ENGINE GENERATOR SETS

75 kw West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	rpm.
1	1500	West.	CW	2200	435
1	700	G.E.	MT-432	2200	393
1	400	West.	CW-967A	220/440	1170
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	M	2200/220/440	600
1	100	West.	CI	220/440	1750
1	100	G.E.	I-M-16	2200	450
2	100	West.	CW	2200	580
1	75	West.	CW	220	875
1	60	West.	HF	2200	690
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	53	G.E.	I-M	220/550	1165
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125

SYNCHRONOUS MOTORS

1—125 kw. G.E. type ATB, 220/440 v. 3 ph. 60 cy. 900 rpm., 80% PF.

SPEED REDUCERS

20—¼ HP Pgh. Gear & Mach. 720 rpm. Ratio 52:1

26—½ HP Pgh. Gear & Mach. 840 rpm. Ratio 52:1

1—½ HP D. O. James 600 rpm. Ratio 12:1

1—½ HP D. O. James 600 rpm. Ratio 36:1

1—¾ HP D. O. James 600 rpm. Ratio 12:1

1—¾ HP D. O. James 900 rpm. Ratio 36:1

1—1 HP D. O. James 600 rpm. Ratio 9:1

1—1 HP D. O. James 600 rpm. Ratio 20.-53:1

1 —1 HP D. O. James 1200 rpm. Ratio 12:1

15—1 HP Pgh. Gear & Mach. 1800 rpm. Ration 52:1

1—1 HP D. O. James 1200 rpm. Ratio 36:1

1—1½ HP D. O. James 900 rpm. Ratio 9:1

1—1½ HP D. O. James 900 rpm. Ratio 20.53:1

1—2 HP D. O. James 1700 rpm. Ratio 12:1

1—2 HP D. O. James 1700 rpm. Ratio 36:1

1—2 HP D. O. James Ratio 1200 to 133

1—2 HP D. O. James Ratio 20.53:1

1—3 HP Farrell Birmingham 1160 to 193 rpm. Ratio 6:1

3—7½ HP Herringbone D. O. James 900 rpm. Ratio 6.2:1

3— 10 HP Herringbone D. O. James 1200 rpm. Ratio 6.2:1

5— 10 HP D. O. James Ratio 28:1

7— 10 HP Horsburg & Scott 1200 rpm. Ratio 6:1

1—150 HP Falk 1200 rpm. Ratio 7.31:1

1—150 HP Nuttal Ratio 1.6:1

1—450 HP Kerr 3800 rpm Ratio 5.28:1

TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Pri.	Sec.	Make	Ph.
1	250	2300	460	G.E.	
3	150	22000	6900	Pgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	3 ph
2	50	2300	220/440	G.E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G.E.	
2	30	440	220/110	West.	
25	25	2200	122/244	G.E.	
3	15	2200	122/244	G.E.	
35	10	2200	122/244	G.E.	
40	10	2200	122/244	West.	
100	7½	2200	122/244	G.E.	
50	7½	2200	122/244	West.	
50	5	2200	122/244	G.E.	
75	5	2200	122/244	West.	
1	5	550	110/220	Pgh.	
1	3	2200	115/230	G.E.	
4	2	2080	115/230	G.E.	
3	1	4400/2200	122/244	West.	

SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.
1— 68 HP G.E. CO-2007, 475 rpm.
1— 50 HP Shaw.
1— 50 HP West. K-10 (500 v.) 435 rpm.
1— 30 HP G.E. CO-2002, 610 rpm.
1— 15 HP Crocker Wheeler 270 rpm.
6— 2 HP Reliance, 850 rpm.

AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100# pres. 285 rpm., belt driven by 40 HP G.E. AC slipring Motors.

SQUIRREL GAGE MOTORS—3 ph. 60 cy.

Qu.	HP	Volts	Make	Type	Speed
25	½	220/440	Cr. Wh. with reducers	speed	840
29	1½	220/440	Ilg.		490
25	2	220/440	Cr. Wh.		685
6	5	220/440	G.E.	vert.	1150
25	7½	220/440	Cr. Wh.		675
2	15/30	220/440	West.	MS	550/1100
7	50	220/440	Wagner		850
3	60	220/440	Allis Chal. with		1150
2	60	220/440	Cr. Wh.		670
2	75	220/440	G.E.	I-K	720
1	75	220/440	West.		750
1	125	440	G.E.	I-K	720
1	125	220/550	G.E.	I-K	400
1	125	440	G.E.	I-K	450
1	125	440	G.E.	I-K	514
1	125	220/550	G.E.	I-K	850
1	150	220/440/550	G.E.	I-K	514
1	150	220/550	G.E.	I-K	450
1	150	550/220/440	G.E.		575
1	200	2200	West.	CS	870
1	200	220/440	West.	CS	580
1	200	2200/440/220	West	CS	250
1	200	440	G.E..	I-K	720
1	200	220/550	G.E.	I-K	600
1	200	220/550	G.E.	I-K	514
1	225	2200/440/220	G.E.	TR	200
1	250	220/550	G.E.	I-K	720
1	300	2200/440/220	West.	CS	400
1	350	2200/440/220	West.	CS	450
1	400	2200/440/220	West.	CS	600
1	450	2200/440/220	West.	CS	600
1	400	2200/440/220	West.	CS	500

DIESEL ENGINE GENERATOR SET

217 KVA G.E. 2300/3/60 dir. con. 260 HP Buckeye 2 cyl. 200 rpm. semi-diesel engine, complete

ELEVATOR

1—Westinghouse Elevator, traction type, 3000 lbs. Cap., platform 6x5, 2 gates on car, 4 sets of bi-parting doors, planed steel tees for main guides complete with AC motor and constant pressure control. All automatic.

INDUSTRIAL TRUCKS

3—Elwell Parker Tow Tractors 7' L. x 42" W. x 42" H. 4-16" wheels, ball bearing, 4 wheel steer, 4 wheel drive, 2000# DBP complete with Edison Batteries.

1—Baker Tow Truck 8'1x64"hx48" w.

100—small steel trucks with oak platforms 42"x24" heighth 17" with 4—12" roller bearing wheels and 5th wheel including handles.

SCALES

6—Fair. Morse # 11½ 3 beams (2—200# ea. 1—50 lbs.) platform 16¼x21⅝.

9—Howe Scales 3 beams—platform 14½x22.

★ *FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW— BUY WAR SAVINGS BONDS* ★

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.

1500 KW MOTOR GENERATOR SET

AVAILABLE IMMEDIATE DELIVERY

1—ALLIS CHALMERS Motor Generator Set consisting of:

1500 KW, 600 Volt Direct Current Generator Direct Connected to a 2190 HP, 3 Phase, 60 Cycle, 4000/6600 Volts, 300 RPM Synchronous Motor.

TURBINE-GENERATOR UNITS

3 phase, 60 cycles

6250 KVA Westinghouse condensing 175-200 lb. press., 2300 volts, complete with surface condenser and auxiliaries.

3125 KVA Westinghouse 180-200 lb. pressure, 500° T.T. 2300 volts, 3600 RPM equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments—(a complete installation).

1875 KVA G.E. condensing, 175 lb. press. 500° T.T. 2300 volts, 3600 RPM complete with surface condenser and condensing auxiliaries.

1563 KVA G.E. condensing 175-200 lb. press. 500° T.T., 2300 volts, 3600 RPM complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. press., 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

375 KVA (2) G.E. non-condensing 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete w. dire. connected exciter and rheostats.

TURBINE GENERATOR UNITS (Con't.)

125 KVA G.E. non-condensing, 125-150 lb. pressure, 10 lb. back pressure, 240 volts, 3600 RPM, with direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM direct current generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lbs. pressure, equipped with Westinghouse surface condenser, switchboard and instruments.

600 KW Crocker - Wheeler 250 volts, 300 RPM direct connected to a 14" x 18", 4 clinder Ames vertical Unaflow non-condensing engine, 150 to 175 lb. pressure, 5 lb. gauge back pressure complete switchboard and instruments.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24" x 26" Skinner Unaflow non - condensing engine, 110-150 lb. pressure 5 lb. back pressure, complete switchboard and instruments.

150 KW Crocker-Wheeler, 125 volts, 200 RPM direct connected to an Erie Ball single cylinder, 4-valve, non-releasing Corliss engine complete with switchboard.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non - condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

500 KVA G.E. 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

438 KVA General Electric 2300 volts, 200 RPM alternating current generator direct connected to Busch Sulzer vertical full Diesel engine.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. press., 6 lb. gauge back press.

300 KVA G.E. 240 volts, 120 RPM direct connected 18"x 36" Hamilton Corliss engine, 125-150 lb. pressure, 5 lb. gauge back pressure, complete exciter, switchboard and instruments.

135 KVA General Electric 2300 volts, 277 RPM alternating current generator direct connected to Busch Sulzer *vertical full Diesel engine.*

MOTOR GENERATOR SETS

100 KW Triumph 250 volts direct current generator direct connected to 150 HP, 3 phase, 60 cycle, 2300 volts, 900 RPM squirrel cage motor.

30 KW General Electric 125 volts direct current generator direct connected to 50 HP, 3 phase, 60 cycle, 2300 volts, 720 RPM squirrel cage motor.

13.5 KW General Electric 125 volt direct current generator direct connected to 20 HP, 3 phase, 60 cycle, 440 volt, 900 RPM squirrel cage motor.

MOTORS

3 phase, 60 cycle

1500 HP Allis-Chalmers, 2300 volts, 200 RPM slip ring.

625 HP G.E. type ATI, 2200 volts, 257 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

150 HP (5) G.E., form K, 2200 volts, 580 RPM, in the 4 million series, each complete with G.E. automatic compensator.

MOTORS (Con't.)

125 HP 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

30 KW G.E., 125 volts, 625 RPM, type RC compound wound direct current generator.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1055 cubic feet, 100 lb. air-pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

512 HP Babcock & Wilcox Sterling 4-drum water tube boiler code construction, 200 lb. pressure, single setting complete with stoker.

Synchronous condensers 1350 KVA total capacity

750 KVA and 600 KVA, General Electric type, ATI, 3 phase, 60 cycle, 240 V., 900 RPM syn. condensers.

Each unit complete with dir. conn. exciter, switchboard panel with instruments.

Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

SHELL MAKER JUMPED the GUN with REBUILT MACHINERY

in PRODUCTION 2 YEARS AHEAD of TIME

ALL NECESSARY EQUIPMENT FROM ONE SOURCE

• A shell manufacturer had to produce as soon after organization as possible. There was only one quick solution—used machinery. Where? From O'Brien. O'Brien furnished over 200 different machine tools plus operating equipment—an entire automatic department, a complete hand screw machine department, a complete forge shop, a heat treating department, a fully equipped tool room, a metal stamping shop and all air compressors, boilers, oil burners, pumps, etc. Later, O'Brien supplied a complete shell loading plant.

ONE SOURCE . . . ONE RESPONSIBILITY

A Selected List of Current Offerings—Subject to Prior Sale

AIR COMPRESSORS

CFM	MAKE	SIZE	TYPE
2312	Ingersoll-Rand	20x20x16	Steam
1400	Ingersoll-Rand	22x14x16	Steam
1156	Ingersoll-Rand	20x12½x16	Steam
1198	Ingersoll-Rand	16x16x14	Belt
888	Ingersoll-Rand	19x12x16	Belt
599	Ingersoll-Rand	16x10x14	Belt
528	Ingersoll-Rand	14x12	Belt
368	Ingersoll-Rand	12x10	Belt
368	Ingersoll-Rand	10x12x10	Steam
311	Ingersoll-Rand	12x8	Belt
311	Pennsylvania	12x8	Belt
240	Pennsylvania	10x9	Belt
215	Ingersoll-Rand	10x8	Belt
173	Ingersoll-Rand	9x8	Belt
173	Ingersoll-Rand	8x9x8	Steam
92	Ingersoll-Rand	7x6	Belt
92	Ingersoll-Rand	7x7x6	Steam

A. C. TURBINE UNITS

4000 KVA Al. Ch. Cond., 3/60/2300/3600 RPM
2—3125 KVA G. E.—Curtis Cond., 3/60/2300/3600 RPM
2500 KVA West. Cond., 3/60/600/3600 RPM
1500 KVA West. Cond., 3/60/600/3600 RPM
750 KVA G. E. Cond., 3/60/600/3600 RPM
625 KVA G. E.—Curtis Cond., 3/60/2300/3600 RPM
625 KVA West. Non-cond. geared, 3/60/2300 volt, 6000/900 RPM
500 KVA West. Cond., geared, 3/60/2400 volt, 6000/900 RPM.
375 KVA West. non-cond., geared, 3/60/2400 volt, 6000/900
375 KVA G. E. cond., 3/60/240/3600 RPM
125 KVA G. E.—Moore non-cond., 2 or 3/60/220 New 1932
75 KVA Al. Ch.—DeLaval, non-cond., 3/60/240/3600 RPM

MOTOR GENERATOR SETS

100 KW General Electric 3-unit Set with 2—500 KW, 150 volt D.C. Generators—1400 HP Synchronous 3 phase, 60 cycle, 4000 volt 514 RPM
275 KW Allis-Chalmers 3-unit Set, 450 RPM—150 KW Gen., 150 volt and 125 KW Gen., 240 volt 400 HP Syn. Motor, 3/60/4500 volt
150 KW Ridgeway 250 volt—3/60/2300/900 RPM Syn.
100 KW Cr. Wh., 250 volt—3/60/440/1800 RPM
75 KW West. 125 volt, 112 HP sq. cg., 3/60/2300/1200 RPM
50 KW G. E., 125 volt—3 phase, 60 cycle, 2200 volt, 720 RPM
35 KW Fairbanks-Morse 250 volt, 60 HP Synchronous Motor, 3/60/220/1200 RPM
25 KW Westinghouse, 125 volt, 1200 RPM, 3/60/220 volt

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse, 1000 K.W. 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10# G. back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

POWER PLANT EQUIPMENT CO., INC.

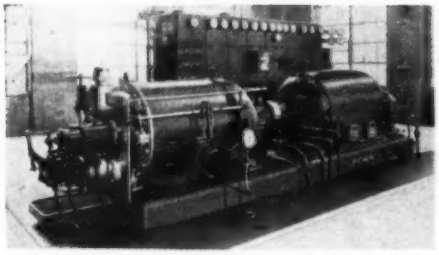
39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA. G.E. 2300 V. Cond.
2500 KVA G.E. 2300 V. Cond.
1875 KVA Al. Chal. 2300 V. Cond.
1500 KVA Al. Chal. 480 V., low press.
1250 KVA G.E. 2300 V. Cond.
1000 KVA Wghse. 2 ph., 600 V. Cond.
937 KVA Al. Chal.-Moore 480 V., Non-Cond. and bleeder
937 KVA Al. Chal. 2300 V. Cond.
937 KVA Al. Chal.-Elliot Mixed Pres.
780 KVA Al. Chal. 2300 V. Con.
780 KVA Al. Chal.-Terry 600 V.; Auto bleeder
625 KVA Wghse. 2300 V. Cond.
625 KVA G.E. 2300 V. Cond.
625 KVA Al. Chal.-Elliot 240/480 V. Auto bleeder
375 KVA G.E. 2300 V. bleeder
375 KVA G.E. 2300 V. Non-Cond.
312 KVA Ridgway-Elliot 480 V. Cond.
250 KVA G.E.-Moore; Auto Bleeder
150 KVA Wghse. 240 V. Cond.

STEAM ENGINE SETS

255 KVA G.E. 240 V. Hamilton Corliss
200 KW G.E. 125 V. with Erie Ball 4 V. Engine
200 KW G.E. 125 V. with Skinner Uniflow Engine
150 KW G.E. 240 V. with Erie Ball 4 V. Engine
125 KW G.E. 240 V. with Erie Ball 4 V. Engine
100 KW G.E. 240 V. with Erie Ball 4 V. Engine
100 KW G.E. 125 V. with Erie Ball 4 V. Engine
20 x 21 Skinner Uniflow, belted, 175 lbs. (15 to 25 lbs. b.p.)



• BLEEDER TURBINE UNIT

625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condenser

TRANSFORMERS

687 KVA (2) Maloney 13800—460 V.
500 KVA (3) Al. Chal. 33000—440 V.
250 KVA (3) Packard 22000—2300 V.
250 KVA (2) G.E. 6600-2300 V.
150 KVA (2) G.E. 2300/4000-115/230 V.
100 KVA (3) Al. Chal. 22000—440 V.
100 KVA (6) G.E. 13200—2300 V.

FIRE PUMPS (Motor Driven)

1600 GPM Al. Chal. 216' head; dir. con.
1500 GPM Worthington 216' head; dir. con.
850 GPM Al. Chal. 243' head; dir. con.
8" Hill 2 stage; dir. con.

STOKER

1—Illinois Chain Grate for 1300 HP
2—Illinois Chain Grate for 350 hp.
2—Taylor Underfeed for 550 hp.
1—Combustion Engrg. Underfeed for 250 hp.

COAL PULVERIZERS

8000 lbs. Fuller Bonnett; Motor Driven
6000 lbs. Whiting; Motor driven
2—4500 lbs. Erie City; Motor Driven

BOILERS (ASME)

749 HP (4) Edgemoor 200 lbs.
500 HP Murray (Heine) 180 lbs.
471 HP Erie City Vert. 200 lbs.
418 HP Sterling 200 lbs.
300 HP Erie City (Heine) 160 lbs.
298 HP (3) Sterling 200 lbs.
253 HP (2) Heine 160 lbs.

SURFACE CONDENSERS

3850 Sq. Ft. Worthington
2400 Sq. Ft. Al. Chal.
800 Sq. Ft. Wheeler
625 Sq. Ft. Wheeler

DIESEL ENGINE SETS

900 KVA G.E. 3 ph.—McIntosh-Sey.
375 KVA Wghse. 3 ph.—Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
219 KVA G.E. 3 ph.—Worthington
200 KVA G.E. 3 ph.—Busch-Sulzer
50 HP Fairbanks "VA" belted

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 937 KVA Moore-Allis N-C. Bleeder
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.
1— 63.5 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—1000 KVA Copper (gas) 240 V.
1— 720 KW McInt.-Seymour 2300 V.
1— 400 KW West. (gas) 440 V.
1— 312 KVA Anderson 2400 V.
1— 49.5 KVA Fairbanks Morse 120 V.
1— 32 KVA Fairbanks Morse 120 V.

WATER TUBE BOILERS

4—1000 HP Heine 250-lb. Oil Fired
1—1000 HP Edge Moor 200-lb. Stokers
1— 800 HP Connelly 250-lb.Stoker
4— 750 HP Edge Moor 200-lb.
6— 600 HP Stirling 180-lb. Stokers
2— 520 HP Heine 200-lb. Hand Fired
1— 512 HP Stirling 200-lb. Stoker
2— 490 HP Stirling 200-lb.
8— 400 HP Stirling 200-lb.
1— 400 HP B. & W. 160-lb. Stoker
2— 350 HP Stirling 200-lb.
2— 336 HP B. & W. 200-lb. McClave-Brooks stoker
2— 302 HP B. & W. 160-lb.
2— 282 HP Edge Moor 200-lb. Stokers

SYNCHRONOUS MOTORS—60 Cy.

2—800 HP Electric Machy. 6600 V. 450 RPM
1—200 HP General Electric 2200 V. 1800 RPM
1—175 HP General Electric 230 V. 225 RPM
1—175 HP General Electric 220 V. 200 RPM
1—150 HP General Electric 440 V. 164 RPM
1—100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
2— 800 HP G. E. slip ring 2300 V. 300 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM

MOTOR GENERATOR SETS—60 Cy.

1—1500 KW General Electric 600 V. DC
1—1000 KW General Electric 600 V. DC
1— 500 KW General Electric 600 V. DC
1— 300 KW General Electric 275 V.DC
1— 75 KW General Electric 125 V. DC

ROTARY CONVERTERS—60 Cy.

1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

OIL CIRCUIT BREAKERS

1— 300 A. 87 KV Am.Br. Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO36 Outdoor
2— 600 A. 37 KV Conduit FO40A Outdoor
4— 400 A. 34.5 KV Conduit F-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 25 KV West. CO-2 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G. E. FKO-60-B Outdoor

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 2300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1— 100 KW G. E. 25/60 cy. 300 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

SYNCHRONOUS CONDENSERS

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
3— 500 KVA Allis 33000/480 V.
6— 250 KVA Penn 34500-17250/4600-2300 V.
1—10000 KVA G. E. 26400/4580 V. 3 ph.
1— 6000 KVA G. E. 26400/2300 V. 3 ph.
3— 1500 KVA Pitts. 22000/6600 V.
2— 1000 KVA G. E. 23000-11500/575 V.
4— 667 KVA West. 22000-11000/2300 V.
3— 250 KVA G. E. 22000/11000 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 150 KVA Pitts. 13800/230-460 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3— 1250 KVA G. E. 6600/550 V.
3—1000 KVA Pitts. 2300-4600/550 V.
3— 667 KVA G. E. 2300-4000 Y/500-480-460 V.
6— 100 KVA Pitts. 2300/575 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY

CHICAGO ELECTRIC REBUILT POWER EQUIPMENT

—the immediate answer to your power problems!

MOTOR-GENERATOR SETS

800 KW Elliott 250 v DC 440 v. syn.
500 KW Westg. 250 v DC 2200 v. syn.
235 KW Westg. 115 v DC 2200 v. syn.
225 KW Ideal 115 v DC 2200 v. syn.
150 KW Ideal 250 v. DC 440 v. syn.
100 KW G.E. 3-wire, 2200/440, ind.
100 KW Allis C. 3-W. 4000/2200 ind.
100 KW G.E. 250 v. 2200 v. ind.
100 KW Wtg. 125 v. DC 2200 v. ind.
100 KW Al. Ch. 125 v. DC 440 v. syn.
90 HP Wtg. 110 v. DC 75 KVA 2200 v.
75 KW G.E. (2) 125 v DC 3/25/220 AC.
75 KW G.E. 125 v DC 220 v. syn.
75 KW G.E. 250 v DC 440 v. ind.
75 KW G.E. 250 v DC 2200 v. syn.
70 KW G.E. 125 v DC 220 v. syn.
50 KW Al. Ch. 115 v DC 2200 v. ind.
50 KW Al. Ch. 125 v DC 2300/440 ind.
33 KW G.E. 110 v DC 2200 v. syn.
22½ KW G.E. 125 v DC 220/440 ind.
15 KW Ideal 240 v DC 220 v. ind.
25 KW Chandeysson 125 DC 220 AC ind.
20 KW G.E. 230 DC 220 AC ind.
7½ KW Jenney 110 v balancer.
4 KW Hertner, vert.charger 45 v 220/440 AC.
3.3 KW Wtg. 250 DC 10 KVA AC. gen.
4 KW Hertner. vert. charger 90/106 DC 1-6 v 110 AC.
3 KW Lincoln 92/115 DC 1-6 v 220 AC.
2.5 KW Robbins-Myers 115 DC both ends.
2½ KW Acme Vert. 45 v DC 3-6 v 220 AC.
2.4 KW Lincoln 80 v DC 3-6 v 220.
2.5 KW Wotton 80 v DC 1/60/110/220 AC.
2 KW G.E. 110 v DC 3/25/440 AC.
2 KW Elec. Spec. 750 v DC 3/60/440 AC.
1.5 KW G.E. 750 v DC 3/60/440 AC.
2 KVA Roth 1/60/110 220 v DC.
1 KW Holtzer Cab. 46 v DC 220 v DC.
.5 KW R. & Myers 115 v DC to 115 v DC.
.378 KW 110 v G.E. MIC to 1/60/110.
.250 KW R. & Myers 125 v DC 1/60/110 AC.
.250 Rochester 120 v DC 1/60/110/220.
.3 KW Wtg. 25 v DC 3/60/220/440 AC.
.1 KW Wtg. 14 v DC 1/60/104 v AC.

SLIPRING

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	253
1500	Al. Ch.	ANY	2200	485
800	Wtg.	CW	6600	443
500	G.E. (2)	I-M	2200	600
350	G.E.	MT	2300	300
350	Al. Ch.		2200	300
300	G.E.	I-M	240	293
300	G.E.	I-M	2200	514
225	G.E.	I-M	220	600
200	Wtg.	CW	440	870
200	Howell	Rl. brg.	440	600
200	G.E.	I-P	440	1170
200	Wtg.	CW	440	345
200	G.E.	I-L	2200	585
200	Wtg.	CW	440	580
150	Wagner	BR	440	1140
150	G.E.	MT	440	875
150	Wtg.		440	600
150	Wtg.	CW	440	575
150	G.E.	I-M	220	600
150	G.E.	I-M	220	585
100	G.E.	I-M	2300	600
100	West.	CW	440	575
100	G.E.	I-M	220	570
75	Northwestern	HW-50	220	1740
75	Allis Chal.	ARY	220	1160
75	Wtg.	CW	440	1160

SYNCHRONOUS

HP	Make	Type	Volts	Speed
5000	G.E.		2300	82
2100	G.E.	ATI	4600/2300	514
800	Al. Ch.		2200	900
800	El. Machy.		6600	450
750	Westg. (2)		4000/2200	1200
650	Al. Chal.		2200	1200
270	G.E.	ATI	2300	600
200	Wtg.	HR	2200	225
190	Elec. Machy.		440	720

TRANSFORMERS

KVA	QU.	Make	Type	Pri.	Sec.
150	2	Wtg.	SK	2300/115	480/240
125	1	Kuhlman		2300	125
100	1	G.E. (25cy)	HT	9000Y	230

VERTICAL

4—60 hp WTG, BB, 3-60-2200 v. 1750 rpm, with starters.

100	2	G.E.	H	4000/2300	110/220
75	3	Wtg.	S	3810	244/122
75	6	Wtg.	SK	3810	240/122
20	1	Moloney	HE	440	120/240
20	3	Moloney	HE	1150/2300	230/460
7½	1	G.E. 3 ph.	HT	6000Y	230
7½	1	G.E. 3 ph.	HT	2200	230/460
7½	1	G.E.	H	1100/2200	244/488
7½	1	Pitts.	HE	2200	244/488
7	1	Kuhlman air cld.		460	1/1.5/2

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
250	Ideal	A	440	1150
200	Wtg.	CS	440	580
200	G.E.	I-K	440	580
150	Wtg.	CS	2200	1200
4-125	Sln Sg	KJ	2200	1800
75	Al. Ch.		440	865
75	G.E.	I-K	220	695
75	G.E.	I-K (5)	220	570
60	Wtg. bb	CS Vert. (4)	2200	1750
60	Wtg.	CS	220	435
50	Triumph	B-13	2200	1160

FREQUENCY CHANGER

1400 HP 460 volts, 3 phase, 60 cycle, 300 RPM, 1500 amps. 1250 KVA power factor .9 50-deg. rise, type ATI-24, 1250-M-300 form C, with synchronous winding, field amps. 102, 1200 KW, 460 volts, 3 phase, 25 cycle, 300 RPM, 1570 amps. 1250 KVA power factor .8 50-deg. rise type ATI-10-1200-M-300 form C, synchronous winding, field amps. 121, with direct-connected exciter.

WRITE, PHONE OR WIRE

CHICAGO ELECTRIC CO., 1320 W. 22ND ST. CHICAGO, ILL.

Let MacCABE lift your Worries!

OVERHEAD ELECTRIC TRAVELING CRANES

Tons	Make	Span	Current
(2)-1	Maris	35′ 7″	230-VDC. FL. OP.
(2)-1½	Euclid	30′ 0″	115/230-VDC. FL. OP.
(1)-2	P & H	34 8″	230-VDC. CG. OP.
(2)-3	Sprague	20′ 6″	115/230-VDC. FL. OP.
(2)-3	Armington	12′ 4″	230-VDC. CG. OP.

(Sprague & Armington Cranes Underslung Type with Overhang)

(1)-5	Shep. Niles	30′ 0″	230-VDC.
(1)-5	Cleveland	34′ 3″	230-VDC.
(1)-10	Whiting	32′ 0″	220-V-3-PH-60-CY.
(1)-20	P & H	50′ 0″	230-VDC.
(1)-40	P & H	50′ 0″	230-VDC.

230-VDC. CRANE & MILL MOTORS

H.P.	Make	Type	R.P.M.
(1)	P & H	5¼ x 3½	850
(1) 2½	G.E.	C.O. 2502	800
(1) 3½	G.E.	C.O. 2503	800
(1) 2	Shaw	B.E.	930
(1) 2½	Rel.	T	1600
(8) 2½	Westg	K-1	835
(3) 6	G.E.	C.O. 1805	1150
(2) 7½	Westg.	MT-000	
(1) 8	Shaw	Z- #62	640
(1) 10½	C.W.	#6-K	810
(9) 20/30	G.E.	M.D. 104	725/575
(2) 10	Westg.	K-5	550
(14) 30/45	G.E.	M.D. 104½	625/500
(2) 50	Shaw	Z	550
(2) 50	G.E.	C.O. 1810	550
(1) 60	Westg.	K-10	470
(3) 65/85	G.E.	C.O. 1830	700/650
(2) 55/65	Westg.	MCA- #60	550
(2) 65/85	G.E.	C.O. 1811	700/550
(1) 60/80	G.E.	M.D. 106 (With Back Axle Brackets)	550/475
(1) 100	G.E.	C.O. 1812	700
(1) 150	Westg.	MCB	365

Complete Resistors & Drum Controllers with Above G.E.M.D. Motors, Also 75 E. C. & M. Dinky, C.H., G.E., & Westgahe Drum Controllers in Stock 5 to 100-HP.

ELECTRIC TRAVELING GANTRY CRANES

(1)-3-ton Milwaukee 3-motor, A.C. or D.C., 31′ 3″ span, 13′ 3″ overhand each side.
(1)-15/5-ton McMyler, 4-motors, A.C. or D.C., 80′ 0″ span, 35′ 0″ lift.
(1)-50-ton Morgan, 5-motors, (2-25-ton trolleys), 60′ 0″ span, 50′ 0″ overhang each end.

GENERAL PURPOSES 230-VDC. MOTORS

H.P.	Make	Type	Speed
(2) 2	Al. Ch.	#50 DE	1750
(1) 3	Rel.	T-224	3500
(1) 3	G.E.	RLC-111	500/1500
(4) 5	Westg.	SK- #40	850
(1) 5	Westg.	SK- #33	1150/1650
(3) 7½	Westg.	SK-83&103	400/1600
(4) 7½	Westg.	SK- #60	850
(1) 7½ (110-V)	Westg.	SK- #40	1150
(1) 8	Westg.	SK-100	300/1200
(1) 10	Westg.	SK-50	1300
(2) 10	Westg.	SK-70	850
(1) 10	Westg.	SK	400/1600
(1) 15	Rel.	23-OT	300/1200
(1) 25	Westg.	SK	1100
(1) 70 (New)	Rel.	46-I.T.	600/1200

(New E. C. & M. Auto. Panel)

SLIP RING MOTORS

H.P.	Make	Type	Current
(2) 5	G.E.	MTC-5200	220/3/60
(1) 5	G.E.	MTC-5201	220/3/25
(1) 15	G.E.	ITC-5008	220/3/60
(2) 15	G.E.	ITC-5009	220/3/60
(1) 15	G.E.	MTC-5302	440/3/60
(3) 22	G.E.	ITC-5009	220/3/60
(2) 22	G.E.	ITC-5010	220/3/60
(1) 25	G.E.	MQC-5526	220/2/60
(1) 25	Westg.	C.I.	220/2/60
(2) 35	Westg.	C.I.	220/2/60
(2) 37	G.E.	ITC-5011-A	220/3/25
(1) 40	G.E.	ITC-5012	220/3/60
(1) 52	G.E.	ITC-5013	220/3/60

(Many of these equipped with Electric Brakes. We can furnish Drum Type Controllers from Stock.)

T. B. MacCABE COMPANY

4306 CLARISSA STREET PHILADELPHIA, PA.

250 VOLT ROTARY CONVERTERS

1—1500 KW. Westinghouse compound interpole 250 V. D.C., 6 phase, 60 cycle AC Rotary converter, 600 RPM.
3 Single phase, 2300 Volt Transformers 1—DC and 1—AC panel for above.

2—1000 KW., Westinghouse compound interpole 250 volt DC, 6 phase, 60 Cycle AC Rotary Converter 900 RPM.
2—Banks of 3 Single phase, 2300 volt transformers for above and 2—DC and 2—AC panels.

The above in excellent condition.

The above are just a few of the thousand of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

Keystone Power Plant Equipment Co.
8403 Hegerman Street
Philadelphia, Pa.

POWER PLANT EQUIPMENT

TURBO-GENERATORS

1—3000 KW G.E. 600 V. Cond.
1—2500 KW G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW G.E. 240 V. Cond.
1— 500 KW G.E. 2300 V. Mixed P.
1— 500 KW G.E. 600 V. Cond.
1— 175 H.P. G.E. Turbine—only.

AIR COMPRESSORS

1—1214 Cu. Ft. Sull Angle 100#.
1— 782 Cu. Ft.—IR—55#
1— 146—Cu. Ft.—IR—3 stage Belted. 1200#.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM.

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

4—1000 H.P. Heine 250#.
2—335 H.P. B & W Sterlings.

BOILER FEED PUMP

1—Duplex Steam—17″x10″x15″.
1—Duplex steam 12x7x12.

INDUCED DRAFT FAN

1—126,000 CFM to 210 HP Turbines.
1—165,000 CFM to 450 HP Turbine.

Also transformers, engines and cranes
Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

Reconditioned Motors, Generators, Control Equipment, etc.
Send for 32 page stock list.
Electric Apparatus Repair Company
Specialists on Rebuilding Motors, Generators and Controls
1410 No. 6th St., PHILA., PA.

1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
3—GE transformers, 300 Kva, 22000/2300, 1 phase, 60 cycle.
3—50 KW M-G Sets, 250 volt DC, 2300/4000-3-60 AC with switchboard.
Many transformers, motors, generators, etc.
SEND US YOUR INQUIRIES
JACKSON-BAYLEY ELECTRIC CO.
CANTON, OHIO

FOR SALE

2—357 HP, 165# P., W. T. Boilers
1—50,000 Gallon Tank & Tower
1—75 Ton, 65′ Span O. E. T. Crane
1—30 Ton, 40′ Span O. E. T. Crane
1—75 KW, 250 V. Gen. D/C Chuse Eng.
1—250 KW, AC Gen. D/C Chuse Unaflow
1—2″ Capacity Punch Press & Shear
1—150 HP, Heine W. T. Boiler

H. & P. MACHINERY CO.
5819 Enright Ave. St. Louis, Mo.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
5	West.	1200	CCL	2 phase
5	American	600	totally enc.	ball bearing
7½	Gen. Elect.	1800	KT	944
7½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	Nema	365
10	Burke	1800		
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565	I	Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Eect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

MOTOR GENERATOR SETS

1—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors, 3/2200/60/1200 complete with panels.

1—100 KW. Crocker Wheeler 250 v. DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM, complete.

1—75 KW Ridgeway 140 v. DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. Complete.

25 Rotary Converter

1—150 Allis Chalmers Rotary 250 Volts D.C. 500 R.P.M. complete with panels. Transformer 25 cycle, 2300 volts.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
300	Gen. Elect.	1200	I	form M
500	Westinghouse	600	CW	

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
21	25	G.E.	25	2300/230/460
6	40	G.E.	5	2300/230/460
6	30	G.E.	25	2300/115/230
24	50	G.E.	25	2300/230/460
3	50	Packard	25	6900/230/460
18	50	G.E.	60	4160/4600/230/460
3	75	60	60	4160/4600/230/460
18	100	G.E.	60	4160/4600/230/460
3	100	Kuhlman	25	2300/230/460
3	200	G.E.	60	2300/230/460
3	200	G.E.	60	6900/230/460
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pitts.	25	11500/220
3	1000	Pitts.	60	2300/4600/230/460

Prices on Application

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
50	Gen. Elect.	750	I	form K
50	Westinghouse	750	CS	
75	Gen. Elect.	750	KT	357
75	Gen. Elect.	750	I	form K
100	Gen. Elect.	750	I	form K
100	Gen. Elect.	300	117	form K
150	Gen. Elect.	750	I	form K
150	Gen. Elect.	750	I	form K
200	Westinghouse	460	CS	2200 volt
200	Gen. Elect.	750	I	form K
225	Elec. Machinery	500	2200 volt	synhronous
1150	Gen. Elect.	375	2300 volt	synchronous
200	Westinghouse	235	CW	slipring

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring. 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

1—20 HP. Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK, 230 v. DC 475/950 RPM variable speed.

FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

1—120 KVA Gen. Elec. Induction Frequency Changer, 440 V., 3 Phase, 62½ Cycle. Driving motor 100 H.P., 3/25/440 RPM. Complete.

94 KVA Westinghouse Synchronous Set Generator, 63⅓ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

BOILERS

1—2100 HP **Badenhausen** 354# pressure with pulverizers and all auxiliaries.

1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.

5—512 HP **Sterling** Class S-26 200# pressure.

1—600 HP **Connelly** 200# pressure.

2—525 HP **Walsh-Weidner** 200# pressure, Coxe Chain Grate Stokers and all aux.

8—400 HP **Sterling** 200# pressure with pulverized fuel and all auxiliaries.

1—1040 HP **Edge Moor** 200# pressure.

2—250 HP **Sterling Boilers,** 160# pressure equipped with gas burners and controls.

2—253 HP **Sterling Boilers,** 160# pressure with oil burners.

2—250 HP **Wicks vertical Boilers** 160# pressure with pulverizers.

1—624 HP **Edge Moor Sectional Header,** 200# pressure Type E stoker.

3—400 HP **Heine Boilers,** 160# pressure with chain grate stokers and auxiliaries.

1—685 HP **Sterling Boilers** 200# pressure with chain grate stoker.

2—500 HP **Edge Moor Boilers** 200# pressure.

4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.

1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.

1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.

2—484 HP **Springfield Boilers** 200# pressure.

1—520 HP **B&W Sectional Header Boiler,** 200# pressure.

1—Complete **Power Plant** consisting of 2—309 HP **Heine Marine Boilers** 225# pressure and 2 General Electric Turbines with all auxiliaries.

1—150 HP **Scotch Marine** 150# pressure.

2—150 HP **Lebanon HRT Boilers** 150# pressure with all trimmings including pumps and heater.

1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.

1—150,000# **Badenhausen** Boiler 350# pressure with pulverizer, all auxiliaries.

3—250 HP **Erie City** vertical boilers with pulverizers.

1—400 HP **Connelly** Boiler 160# pressure with new tubes and auxiliaries.

2—84" x 20' **HRT Boilers,** 135# pressure all auxiliaries.

6—443 HP **B&W Sectional Header Boilers,** 200# pressure.

1—125 HP **Lebanon** Locomotive Boiler 150# pressure.

56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.

1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.

1—2500 KW **General Electric Condensing Turbine** with auxiliaries.

1—2500 KW **General Electric Turbine** 400# pressure, Surface Condenser.

1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.

1—937 KVA **Allis-Chalmers Turbine.**

1—625 KVA **General Electric Turbine** with jet condenser.

1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.

1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.

1—250 KVA **Waite Turbine** either condensing or non-condensing.

1—250 KVA **General Electric non-condensing Turbine.**

1—125 KW **General Electric non-condensing turbine.**

4—250 HP **HRT Boilers** 150# pressure

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**

1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.

1—480 KW **Rice & Sargent** 3-60-550 volt engine.

1—375 KVA **Chuse Corliss eng. generator.**

1—375 KVA **Chuse vertical Uniflow engine.**

2—312 KVA **Skinner Uniflow engines.**

1—166 KVA **Ames Uniflow engine generator set.**

2—125 KVA **Skinner Counterflow engine generator sets.**

DIESEL ENGINES

1—300 KVA **Fairbanks-Morse** Full Diesel engine generator set.

1—450 HP **Cooper-Bessemer** Tex rope driven to 300 KW AC Generator.

1—**Complete Gas Engine Plant** consisting of 2—375 KVA **Sterling** and 2—125 KVA **Sterling engines.**

1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel,** 1—225 KVA **Atlas Full Diesel,** 1—94 KVA **Caterpillar Diesel.**

5—180 HP **Fairbanks-Morse** Model 35 oil engines.

4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**

1—2000 HP **Cochrane Metering Feed Water Heater.**

1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**

1—#8 **Fuller Bonot** Pulverizer.

2—Type AA-6 10 retort **Taylor Underfeed Stokers.**

2—6 Retort **Taylor** Underfeed Stokers with fans.

1—6' x 6'6" **Detroit** underfeed stoker.

3—72 x 18' **HRT Boilers** 150# pressure with Detroit underfeed stokers, complete plant.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

835 Security Trust Bldg. INDIANAPOLIS, IND.

SEARCHLIGHT SECTION

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	440	Whse.	514
350	220-440	G.E.	1800
350	2200	G.E.	600
300	2300-4000	G.E.	1200
250	440-550	G.E.	600
200	2200-550	G.E.	1800
200	2200-440	G.E.	600
150	440-220	G.E.	1800
150	2200	G.E.	900
150	2200-440	Whse.	1800
150	550-2200	G.E.	1800
125	440-220	G.E.	600
100	550-2200	G.E.	720
100	440-220	G.E.	1800
100	220-440	G.E.	720
100	220-440	G.E.	900
75	220-440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	2200	Whse.	900
400	440-220	Whse.	276
1—350	440-220	G.E.	900
350	440-220	G.E.	200
240	2300-440-220	G.E.	600
200	2300-4000	G.E.	1200
	150 2200	G.E.	1800
	100 440-220	G.E.	1200

TRANSFORMERS—60 CYCLE

3—667 kva., G.E., 2300/4000-460/480 Volts.
3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—350 kva., G.E., type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E. 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva. Whse. 22,000-2300.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300 V., Westghse.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
50	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	900
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

2—200 KW 125 V. 900 RPM Whse. Con. to 300 HP 2200 V. 3 Ph. 60 Cy. Ind. Motor. Also
1—100 KW 125 V. 900 Rpm GE Con. to 150 HP 200 V. Ph. 60 Cy. Ind. Motor.
1—75 K.W., 250 V., 1800 R.P.M., Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy.
1—50 K.W., 250 V., 720 R.P.M. Whse., Type SK con. to 75 H.P. 220/440 V., 3 ph., 60 cy. Sq.c.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

SYNCHRONOUS CONVERTERS

500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

300 KW G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM
250 KW. G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM
200 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

TURBO GENERATOR SET

300 KW GENERAL ELECTRIC-CURTIS, 250 V. D.C. Turbine, Non-Condensing, 100# Steam Pressure, 3600 RPM. Gen. ELEC. 300 KW. MPC Generator and D.C. Panel.

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

1—3000 KW. TURBO 60 CY. 3 PH. 480 V. WITH COND.
1—4000 KW. TURBO 4150 V. 60 CY. 3 PH. WITH COND.
7500 KW 5000 V 60 CY 3 PH TURBO WITH SURFACE COND.

Heat Exchanger 606 tubes 1¼ x 9' 6" long.
1500 CFM 2 STAGE AIR COMP. 275 HP. SYN. MOTOR DRIVE.
3—100 KW. 125-250 V. DC G.E. TURBOS Non-Cond.
1—New Fan 66750 CFM 2" to 6" Press.
4—Cent. Pumps 4166 GPM, 162' Head with AC Motors.
2—800 HP. 60 CY. 3 PH. 450 RPM MOTORS.
1—2500 HP. 240 RPM, 6600 V. 60 CY. 3 PH. MOTOR, AUX.
Traveling Crane 75 ton Case, 64' span, 3 Motors.
750 KW. and 110 KW. AC Hydro Elec. Plants (also others).
2—150 HP. HRT BOILERS and Stack.

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

BOILERS

NEW and USED!

All makes & sizes for prompt shipments

1—800 H.P. B&W. Stirling 250#
2—500 H.P. Stirling 160#
6—500 H.P. Edge Moor 200#
2—518 H.P Heine 225#

J. F. DAVIS CO.

122 S. Michigan Ave. CHICAGO

COMPLETE POWER PLANTS

WHAT DO YOU REQUIRE?

SPECIALS

2000 KW Turbo-Generator, 60-3-480 V. Surface Condenser, Reconnect 600 V.—2300 or 4000 V. Rewind in 5 Weeks
1500 KW-Non Cond. Turbo Generator Unit 3600 RPM
5000 KW otherwise as above, except 2300/4000

3500 KW	Turbo 60-3-2300 V. Jet Cond.	Non-Cond. Turbo-Gen.
2500 "	" " " Surface Cond.	
1500 "	" " " Jet Cond.	
1250 "	" " " Jet Cond.	1—2000 KW.
1000 "	" " " Surface Cond.	2—1000 KW.
750 "	" " " Surface Cond.	
500 "	" " 60-3-480 V. Surface Cond.	

Boilers 4—1000 HP., 4—750 HP., 2—500 HP., 4—560 HP.

Also Smaller Water Tube & Fire Tube Boilers

CHARLES B. REARICK 30 Church St., New York

2—600 Cu. Ft. Diesel Compressors
2—500 HP. AC Engine Diesel sets
3—100 KW. 240 V. 514 RPM. Diesel sets
2—250 HP. BOILERS 160#, guaranteed

Stephen A. Douglass Co.

630 Fort Washington Ave., New York, N. Y.

DIESEL ENGINES

2—New F.M. 120 H.P., MODEL 35-E, 4 cyl.: 8¾" x 10½"; 450 RPM; Full Solid Injection; Mounted on Steel Base with Twin Disc Clutch and Outboard Bearing—Very Latest Type, never used. We also have many others.

ILLINGWORTH ENGINEERING CO.

321 Hildebrandt Bldg. Jacksonville, Florida

300 KW ROTARY CONVERTER

1—300 KW Westinghouse Rotary Converter, 600 volts, D.C., 6 phase, 60 cycles, pedestal bearings, 1200 RPM.

SYNCHRONOUS MOTOR

1—250 HP Westinghouse Type HR, for 3/60/2200 volts, 277 RPM, Engine Type.

DEEP WELL PUMPS

2—600 GPM, 116 ft. Kingsford Centrifugal Pumps driven by 40 HP General Electric Type CD, 230 V. DC motors

HOIST

1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums side by side with or without motor. AC or DC.

ELECTRIC EQUIPMENT FOR INDUSTRY

LET US KNOW YOUR REQUIREMENTS

REBUILT & GUARANTEED STOCK
MOTORS, D.C. & A.C.
TRANSFORMERS
MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

100 KW ROTARY CONVERTER

1—100 KW General Electric Rotary Converter, Type TCC, 250 volts D.C., 3 phase, 60 cycles, 2300 volts A.C.

SYNCHRONOUS MOTOR

1—250 HP Westinghouse Type HR, for 3/60/2200 volts, 240 RPM Engine Type.

CRUSHERS

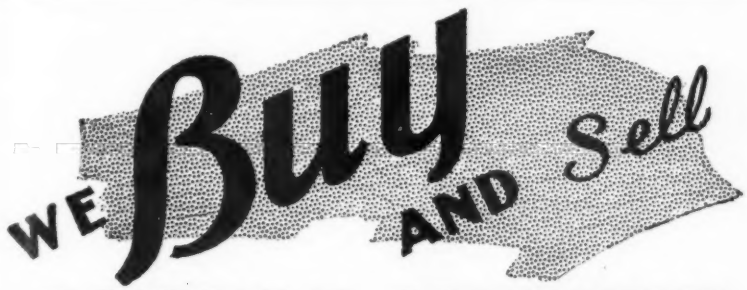
2—36x48" Link Belt Double Roll Crushers for 1½" to 3" size

DYNAMOMETER

1—Taylor "Hi-Eff" Dynamometer for miscellaneous engine and other types of testing.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** 714-15 EMPIRE BLDG. PITTSBURGH, PENNA.



ELECTRICAL EQUIPMENT

PUT IT INTO PRODUCTION—IF YOU CAN'T WE CAN

CALL CANAL—6 6976

"LAND"

WE ARE READY TO PURCHASE

15 KW, 25 KW, 50 KW, 100 KW, 150 KW — **MOTOR GENERATOR SETS 125 OR 250 VOLTS**

10 H.P., 15 H.P., 25 H.P., 50 H.P. — **MOTORS, D. C 125 VOLT**

ODD VOLTAGE MOTOR GENERATOR SETS ALL SIZES
A.C. AND D.C. CONTROL EQUIPMENT
ALTERNATORS, 900 AND 1200 R.P.M.
ALL TYPES OF BELTED GENERATORS

WE HAVE AVAILABLE *IN STOCK*

A. C. EQUIPMENT

SYNCH. MOTORS
200 H.P. G.E. TS 514 RPM

SLIPRING MOTORS
500 H.P. A-C—1200 RPM
250 H.P. G.E., 240 RPM (2)
250 H.P. G.E., 600 RPM
200 H.P. G.E., 720 RPM
200 H.P. G.E., 514 RPM
125 H.P. Burke, 600 RPM
75 H.P. West., 1200 RPM (5)
64 H.P. G.E., 585 RPM
60 H.P. West., 1200 RPM
60 H.P. West., 290 RPM
(180 additional slipring motors, 1 to 50 H.P. in stock.)

SQUIRREL CAGE MOTORS
200 H.P. G.E., 600 RPM
150 H.P. G.E., 600 RPM
100 H.P. Cr.-Wh. 1800 RPM
100 H.P. West., 720 RPM (4)
100 H.P. G.E., 720 RPM (2)
100 H.P. G.E., 600 RPM
75 H.P. West., 1800 RPM
60 H.P. G.E., 1800 RPM
50 H.P. Allis Ch., 720 RPM
50 H.P. G.E., 720 RPM
50 H.P. G.E., 600 RPM
30 H.P. G.E., 514 RPM (2)
25 H.P. G.E., 1800 RPM (25)
(310 additional squirrel cage motors in stock, ¼ to 50 H.P.)

A.C. GENERATORS
200 KW G.E., 600 RPM
150 KW G.E., 900 RPM
150 KW G.E., 720 RPM
100 KVA Cr. Wheeler, 900 RPM
100 KVA West., 600 RPM
90 KW G.E., 900 RPM
75 KW West., 900 RPM
30 KW G.E., 1200 RPM
24 KW F.M., 1200 RPM

D. C. EQUIPMENT

230 V.D.C. MOTOR GEN. SETS
150 KW G.E., 900 RPM
125 KW Curtis, steam turbine
50 KW Burke, 1200 RPM
30 KW G.E., 1150 RPM
(18 additional sets in stock, 1 to 25 KW)

125 V. M.G. SETS
100 KW West., 1200 RPM
90 KW G.E., 1200 RPM
75 KW Ridgeway Syn.
50 KW Star, 1150 RPM
50 KW West., 850 RPM
30 KW G.E., 1150 RPM
(19 additional 125 V. M.G. Sets in stock, ½ to 25 KW)

230 V. D.C. MOTORS
100 H.P. Reliance, 1150 RPM
85 H.P. G.E., 880 RPM
60 H.P. G.E., 1050 RPM
60 H.P. G.E., 900 RPM
60 H.P. Roth, 600 RPM
50 H.P. G.E., 850 RPM
40 H.P. El. Dyn., 1450/2600
40 H.P. G.E., 1700 RPM
40 H.P. Allis Ch., 1150 RPM
40 H.P. Reliance, 625 RPM
25 H.P. G.E., 1150 RPM (3)
25 H.P. West., 850 RPM (2)
25 H.P. G.E., 575 RPM
20 H.P. G.E., 1750 RPM (2)
(235 additional motors, ½ to 20 H.P. in stock)

115 VOLT D.C. MOTORS
90 H.P. G.E., 900 RPM
15 H.P. G.E., 1150 RPM
10 H.P. L.A., 3600 RPM
10 H.P. F.-M., 1150 RPM
10 H.P. West., 850 RPM
7½ H.P. G.E., 1750 RPM
7½ H.P. West., 1150 RPM
7½ H.P. G.E., 850 RPM
(115 additional 115 volt D.C. Motors, ½ to 5 H.P., also in stock)

L. J. LAND and Company

146 Grand St., New York, N. Y.
10th & Exeter Sts., Reading, Pa., York, Pa.

New York City's largest stock Electrical Equipment

ONE YEAR GUARANTEE — OVER QUARTER CENTURY SERVING INDUSTRY

We are actively in the market to purchase your surplus or idle electrical machinery.

Re-built
Motors and Generators

1—400 HP **Westinghouse**, type CW, 3 ph. 60 cy. 440 V. 450 RPM slip ring motor

1—350 HP **Allis-Chalmers**, 3 ph. 60 cy. 440 V. 600 RPM slip ring motor

1—350 HP **Burke**, 3 ph. 60 cy. 440 V. 600 RPM slip ring motor

1—300 HP **Allis-Chalmers**, 3 ph. 25 cy. 440 V. 485 RPM slip ring motor

1—300 HP **Westinghouse**, 3 ph. 60 cy. 440 V. CW slip ring 495 RPM

2—250 HP **Westinghouse**, type CS1012, 3 ph. 60 cy. 440 V. 435 RPM sq. cage

3—250 HP **General Electric**, 3-60-440 V. I-17A 400 RPM

1—200 HP **Westinghouse**, syn. IPF 3 ph. 60 cy. 2200 V. 600 RPM, with direct connected exciter 3 or 2 bearing

1—200 HP **Westinghouse**, 3-60-440 V. CW 1160 RPM slip ring

1—200 HP **Allis-Chalmers**, 3-60-440 V. 514 RPM

1—200 HP **General Electric**, KT, 3-60-2300 V. 1800 RPM

2—150 HP **Allis-Chalmers**, 3 ph. 60 cy. 440 V. 450 RPM slip ring

2—150 HP **Westinghouse**, type CW, frame 1000, 2 ph. 60 cy. 440 V. 450 RPM slip ring

1—125 KW, **Bullock**, 3 ph. 60 cy. 220 V. 900 RPM alternator

1—125 HP **General Electric**, FT557, 3-60-440 V. 1200 RPM splash proof

2—125 HP **Westinghouse**, CS774C 3-60-440 V. 860 RPM Ball Bearing

2—75R. 2200 V. **Fairbanks-Morse**, 1800 RPM, 3 ph. 60 cy. slip ring motors direct connected to 500 GPM 3 stage 300 head pump

1—100 HP **Westinghouse**, type SK, frame 160, 230 V. 1100 RPM

1—100 HP **General Electric**, type CD, frame 123, 230 V. 1200 RPM

1—100 HP **General Electric**, type RF 17, 230 V. 400/1200 RPM

4—100 HP **General Electric**, 3-60-440 V. 495 RPM, MT562 slip ring

1—50 HP **Westinghouse**, type SK, frame 160, 230 V. 565 RPM

1—50 HP **General Electric**, class 5 Form B, 600 V. 600 RPM

1—60 HP **Westinghouse**, type SK, frame 160, 230 V. 680 RPM

1—100 HP **Westinghouse**, type CCL, 3 ph. 60 cy. 220 V. 1750 RPM sq. cage

1—100 HP **Allis-Chalmers**, type ANY, 3 ph. 60 cy. 220 V. 690 RPM slip ring

1—75 HP **Allis-Chalmers**, 3 ph. 60 cy. 440 V. 450 RPM slip ring

1—75 HP **Westinghouse**, type CW, 3 ph. 60 cy. 440 V. 720 RPM slip ring, 3 or 2 bearings

1—75 HP **Fairbanks-Morse**, type H, frame 165C, 3 ph. 60 cy. 550 V. 900 RPM sq. cage

1—75 HP **Lincoln**, type IQ, 3 ph. 60 cy. 440 V. 600 RPM sq. cage

1—75 HP **General Electric**, type CD, frame 176-550 V. 250/1000 RPM (planer)

1—75 HP **Reliance**, 3-60-440 V. 720 RPM, totally enclosed fan cooled

1—75 HP **Allis-Chalmers**, 3-60-440 V. 600 RPM slip ring

1—75 HP **General Electric**, 3-60-440 V. 600 RPM, MT558, slip ring

2—40 HP C & C, 230 V. 250/1000 (planer)

The Wente Electric Co.

207 N. Fourth St. Hamilton, Ohio

Est. 1903

POWER EQUIPMENT FOR PROMPT SHIPMENT

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
450	West.	2200/220/440	600	CS
400 (5)	West.	2200/220/440	500	CS
350	West.	2200/220/440	500	CS
200	Al. Ch.	2200	600	
150	West.	220/440	580	CCL
125/40	Cr. Wh.	2200	700	125AQ
125	Burke	220/440	1200	
125	Cr. Wh.	2200	700	125AQ
100	Al. Ch.	2200	900	

DC SERIES WOUND MOTORS

HP	Make	Type	Speed
2	R & M	122	1000
5	R & M	125	1000
15	West.		650
25	Shaw		600
50	Shaw		600
75	G.E.	211 Int.	550
100	G.E.	MD 108	480
130	G.E.	CO 1812	550
175	G.E.	MDS 1903	475

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
300	Al. Ch.	2200	600
75 (2)	G.E.	2200	900

SLIP RING MOTORS, (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G.E.	2200	393	MT 432
300	G.E.	440	600	I-M
200	G.E.	2200	240	MT 412
150	G.E.	220/440	720	I-M
150	G.E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G.E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G.E.	2200	600	I-L
150	G.E.	2200	600	I-L
125	G.E.	2200	600	I-L

OIL ENGINE DRIVE AIR COMPRESSOR

Chicago Pneumatic simplate valve type, NS03 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.

M-G SETS 3 ph. 60 cy. (Syn.)

165 KW G.E. Type HCC 6 Rotary Con. 230 v. DC 2200/4000/3/60 Trans.
150 KW G.E. Type HCC 6 Rotary Con. 230 v. DC 2200 or 4000 v. AC
150 KW West. 550 v. DC—2200 AC 1200 RPM
150 KW Ridg. 250 v. DC—2300/3/60 AC
100 KW G. E. 550 v. DC—2200 v. 900 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM

SHOP HOISTS

1—1 Ton Euclid AC Hook type, floor control
1—1 Ton Sprague 230 v. DC
2—2 Ton Sprague 230/500 v. DC Monorail
2—5 Ton Northern AC Monorail Hoists on 35' Cranes

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

MOORHEAD-REITMEYER CO., INC.

Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

2—Edgemoor 500 H.P. 200 lb. working pressure, La Clede chain grate stokers complete.

4—Henry Voigt 500 H.P. 200 lb. working pressure, Illinois chain grate stokers complete.

3—Oil Well 90 H.P. 200 lb. working pressure fire box boilers.

3—110 H.P. 250 lb. working pressure Locomotive fire box boilers.

2—125 H.P. 350 lb. working pressure Locomotive fire box boilers.

2—Complete Sand Batch Hoppers with Link Belt conveying equipment.

6—72x18 H.R.T. 150 lbs.

6—78x20 H.R.T. 150 lbs.

4—84x20 H.R.T. 150 lbs.

"New and Used—not abused"

JOE SULLIVAN CO.

523 N. Hamlin Ave. Chicago, Ill.

Phone Van Buren 8669
Night or Day

SYNCHRONOUS MOTORS AND ALTERNATORS

3 ph. 60 cy. Self Exciter

		Make	Type	Volts	RPM
6.3	KVA	G.E.	ATI PB	220	1200
40	HP	West.	Power factor 65%	220	1800
75	HP	F.W.	VRN	220	1200
100	KVA	C.W.		240	900
3—125	HP	Ideal	Unity PF	440	300

G.E. TRANSFORMERS

Qu.	Type	Pri. Volts	Sec. Volts	Ph.	Cy.
3—15	H oisc	440	110/220	1	25
1—25	HT-G oisc	6600/13200Y	230/115	3	60
1—30	HT-G oisc	6600/13200Y	460/230	3	60
1—50	H oisc	6600	440	3	25
1—75		6600	440	3	25

SLIPRING

HP	Make	Type	Volts	RPM	Phase	Add. Inform.
200	G.E.	Im	440	600	3	#3 Bearing
150	G.E.	IM	2200	720	3	Long Shaft
150	G.E.	IM	440	600	3	
75	G.E.	MT547	220	1200	3	
75	G.E.	MT343	220	1700	3	
75	G.E.	MT343	440	1200	3	
60	Ideal	AVA351	440	600	3	

DC GENERATORS

5—100 KW General Electric Type CDM, 250 volt 850 rpm cpd. wound

D.C. CRANE & HOIST MOTORS

Qu.	HP.	Make	Type	Volt	RPM
2	125	G.E.	CO1832	230	675 series
2	100	G.E.	CO1831	230	675 series
1	65	G.E.	CO1811	230	600 series
2	35	G.E.	CO1809		
2	22	G.E.	CO1807		
1	40	West.	K10	230	525 series
3	40	West.	K9	230	575 series
1	35	Northern	KF	230	800 series
1	33	West.	CK9	230	235
1	30	West.	K7	550	600 series
2	23	West.	K8	230	525 series with brake
1	30	P & H	12x8	230	420 series
1	25	Electro Dynamic		230	550 series wound crane with brake ball bearing

PUMPS & OTHER EQUIPMENT

No. 48 Gould Centrifugal 600 gpm 50 ft. head 1750 rpm.
No. 5 Cameron Centrifugal 600 gpm 100 ft. head. 30 HP West. SK 230 volt 1750 rpm cpd—factory built.
Fairbanks Morse 860 NE. 25 HP F & M H 12B 2200 volt 1800 rpm 3 BB—factory built.
Size No. 6 Morris Machine Centrifugal pump 123386.
Worthington Centrifugal pump 2 stage, 40 HP West. 220 volt 1800 rpm 3 phase syn. motor 65% P. F. dir. conn. exciter—factory built.

SPECIALS

1—300 KW 250 volt DC 900 rpm Westinghouse steam Turbine connected through Westinghouse reduction gear 4.1

We build motor generator sets to order, gasoline driven generator sets, and other special equipment

In Stock Standard Motors ranging from 25 HP to 1000 HP both AC and DC

ALL EQUIPMENT LISTED AVAILABLE FOR DELIVERY ON SHORT NOTICE.

BENJAMIN'S FOR MOTORS, INC.

12TH AVENUE & 37TH STREET
BROOKLYN, N. Y.

Direct Wires to
Western Union & Postal Telegraph
Phone Windsor 5-1700

Your Best Bet for

USED EQUIPMENT

25 ton Browning Locomotive Crane.
75, 125, 200 KVA Generators, 257 rpm.
125 HP Firebox Boiler, 100/250# pressure.
2-250 HP Heine Watertube Boilers 150#.
48" steel stacks 56', 80', 137 foot.
180 HP Fairbanks Morse 3 cyl. Diesel Engine.

Tell Your Needs to

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. St. Louis, Mo.

Have you anything for Sale?

STEAM PUMPING ENGINES

1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14½x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x18x13x24. Fine cond.
Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod & eyebolt, 100# max. pres. on gates, 50# min. Cyl. Operating press.
1—20" Crane 125# Flanged Hand Wheel operating Gate Valve.

SURFACE CONDENSER

1—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail Pump.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

STEEL TANKS—PUMPS

22,000 gal. Tank on 44 ft. Tower.
35,000 gal. Tank on 90 ft. Tower.
40,000 gal. Tank on 100 ft. Tower.
50,000 gal. Tank on 100 ft. Tower.
80,000 gal. Tank on 68 ft. Tower.
100,000 gal. Tank on 40 ft. Tower.
100,000 gal. Tank on 100 ft. Tower.
1,000, 5,000 & 10,000 BBl. Oil Tanks.
3—20,000 gal. Horizontal Oil Tanks.
6—11,000 gal., 12—5,000 gal. Horizontal Tanks.
3—500-750 & 1,000 GPM Steam Underwriters Fire Pumps.

Tanks and Pumps bought and sold.

TIDEWATER

EQUIPMENT & MACHINERY CORP.
60 E. 42nd St. New York, N. Y.

DIESEL GENERATOR

General Electric Generator 37.5 KVA, 3 phase, 60 cycle, 240 volts, driven by direct connected 50 H.P. Buda Diesel 6 cylinder Engine. In service.

RICHARD P. WALSH CO.

Cortlandt 7-0723 30 Church St., N. Y.

BOILERS

2—Single, sectional header with stokers, 450 H. P. (each), 200#
2—500 H. P. Stirling 200#, single
2—Longitudinal drum, box header, 175#
2—Cross drum, box header, 160#

H. P. BREARLEY

3423—91st Street Jackson Heights, N. Y.

BOILERS

2—125 HP HRT's, 125# pressure
2—150 HP HRT's, 125# pressure
1—150 HP HRT 140# pressure
2—225 HP Sterlings, 160# pressure
1—300 HP Union Iron, 200# pressure
1—300 HP Heine, 160# pressure
1—500 HP Sterling, 160# pressure
1—500 HP Sterling, 200# pressure
1—650 HP Sterling, 200# pressure

NATIONAL BOILER AND EQUIP. SALES CO.
2732 North Talbot Ave. Indianapolis, Indiana

NEED POWER EQUIPMENT?

(Try Us!!!)

BOILERS

POWER PLANT with 2, 300 H.P. Boilers complete with 2, 500 KW, 3/60/2300 Turbines and Generators
8—300 H.P. Water Tube Boilers
1—453 H.P. 160# Stirling W. T. Boiler
1—500 H.P. 150# Scotch Marine Boiler, twin fire boxes

COMPRESSORS

327 C.F.M. Ingersoll-Rand 2-stage Imperial Type 10, belt drive
1750 C.F.M. I-R with 300 H.P. motor
1050 C.F.M. Chi. Pneu. Type OCB with 150 H.P. A.C. motor

USED D. C. MOTORS

3 H.P. G.E., 230 V. shunt wound, 1150 RPM
3 H.P. Reliance, 220 V., 600/1200 RPM
3½ H.P. West. Elec., 220 V., 850 RPM
5 H.P. C-W., 220 V., 950 RPM
5 H.P. Watson, Vert., 1300 RPM
5 H.P. G.E., 330 V. comp. wound, 850 RPM
5 H.P. C.W., 230 V., 950 RPM
5 H.P. G.E., 230 V., shunt wound, 1100 RPM
7½ H.P. G.E. Shunt wound, 825 RPM, 230 V. D.C.
7½ H.P. West. #6 Type "S" shunt wound, var. sp.
8 H.P. G.E., 230 V. D.C. 810 RPM
8 H.P. C-W., 220 V., 535/1070 RPM
10 H.P. G.E. shunt wound, 230 V. D.C., 650 RPM
10 H.P. A.C. Inter. duty, 220 V. D.C., 500/1200
10 H.P. Triumph shunt wound, 230 V. D.C., 760 RPM
13 H.P. Westg. #8 type S, 220 V. D.C., var. speed, 375/750 RPM
5 H.P. Westg., 220 V. 500/100 RPM
42/50 H.P. West. 220 V. D.C., variable speed 500/1000 RPM, shunt wound

HOIST MOTORS

2—50 H.P. Ft. Wayne Elec. Co. Type "K", 600 RPM, 220 V. D.C.

GENERATORS

3½ KW F-M Generator, Type CP, shunt wound, 2000 RPM, 20 amps, Frame 5
40 KW G.E. Type MP 110 V. D.C., belt drive, 860 RPM, 360 amps.
200 KW West. #201 SK, comp. wound, 600 V. D.C. with 290 H.P. syn. motor, 3/60/2200, 900 RPM
300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps, 3/60/2200-900 RPM
5000 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

USED A. C. MOTORS

(Squirrel Cage)

15 H.P. Howell, 3/60/440, 600 RPM
15 H.P. Gen. Elec., 3/60/220, 1200 RPM
15 H.P. West., 3/60/440, 850 RPM
15 H.P. Wagner, 3/60/440, 850 RPM
20 H.P. Howell, 3/25/440, 750 RPM
20 H.P. Westg. Type CCL, 3/60/220, 850 RPM
25 H.P. A.C., 3/60/220, 1200 RPM
30 H.P. Westg., 3/60/220, 1800 RPM
30 H.P. Westg., 3/60/440, 840 RPM
30 H.P. Gen. Elec., 3/60/440, 900 RPM
30 H.P. Gen. Elec., 3/60/440, 870 RPM
35 H.P. West., 3/60/440, 800 RPM
37½ H.P. Lincoln Vert., 3/60/220, 1200 RPM
40 H.P. Gen. Elec., 3/60/440, 900 RPM
40 H.P. Gen. Elec., 3/60/440, 870 RPM
40 H.P. Westg., 3/60/440, 870 RPM
50 H.P. Howell, 3/60/440, 900 RPM
50 H.P. Watson, 3/60/440, 1720 RPM
75 H.P. Westg., 3/25/400, 450 RPM

We also have on hand miscellaneous electrical items, such as:

OIL SWITCHES
OIL CIRCUIT BREAKERS
LIGHTING GENERATORS
COMPENSATORS
100 H.P. SOLENOID ELEC. BRAKE

HOISTS

Superior Iron Works single drum, 36" dia., with 80 H.P. G.E. type MTC motor
1 to 4 ton cap. single motor monorail type hoists

IRON & STEEL PRODUCTS, INC.

38 YEARS' EXPERIENCE

13488 S. Brainard Ave. Chicago, Illinois

"Anything containing IRON or STEEL"

CRITICAL MATERIALS

Immediately Available

PIPE (Steel and Cast Iron)
VALVES, FITTINGS
ELECTRIC MOTORS up to 300 HP
PUMPS
TANKS
CORLISS STEAM ENGINES
AIR COMPRESSOR
STRUCTURAL STEEL
SPRINKLER SYSTEM
MACHINE TOOLS
BOILERS—High & Low Pressure
FREIGHT ELEVATORS
FIRE DOORS

Detailed list available

G. T. SHIPMAN

Tel: Austin 2121 AUSTIN, PENNA.

VALVES

INDUSTRIAL & MARINE

METROPOLITAN

PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Saroo, Powell Valves and surplus.
Large Complete Stocks ¼" to 24"
313 EAST 31st ST., NEW YORK CITY
For Hourly Nation-wide Shipments
CALL MUrray Hill 3-3408

CRETON PIPE & FITTINGS

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS & ROTARIES
3 phase, 60 cycle, A.C.

2—West. 250 KW 250 Volt rotaries
1—West. 100 KW 250 Volt rotaries
1—Ridgway 100 KW 250 Volt M-G set 2300 Volt A.C.

VERTICAL MOTORS

1—G. E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance Fan-cooled new 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle

2—G. E. 700 HP 720 RPM 6600/4000/2300 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

ADJUSTABLE SPEED D. C. 230 Volt

1—West Sk-180 100 HP 600/950 RPM
2—Electro Dynamic 60 HP 450/1200 RPM
1—Electro Dynamic 60 HP 525/1100 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—G. E. 25 HP 400/1600 RPM
3—G. E. 35 HP 500/1500 RPM
1—G. E. 15 HP 550/1100 RPM
1—G. E. 10 HP 250/1000 RPM
1—West. 10 HP 400/1600 RPM

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

STEAM GENERATING SET

125 KW 3 Phase, 440 Volts, direct connected to Chuse Horizontal Steam Engine, with Governor Switch Board, Exciter, etc.

SYNCHRONOUS MOTORS

1—275 hp.—600 RPM 440 Volts—7% P.F. G.E. Type ATI 3 Bearing Synchronous Motors with Starters

Reconditioned and Guaranteed

IMMEDIATE DELIVERY

PACIFIC MACHINERY CO.

156 Montgomery St., San Francisco, Calif.
Phone—Sutter 3943

FOR SALE

DIESEL ELECTRIC GENERATOR SET

3 phase, 60 cycles, 220 volts, 600 R.P.M

Consisting of: 60 K. W. BURKE Generator, directly connected to "Standard" 6 cylinder heavy duty Diesel Engine. Complete with exciter, main panel board, and automatic voltage control.

Ask for Details—*A BARGAIN FOR SOMEONE*

MOREY MACHINERY CO., INC.

410 Broome Street New York, N.Y.

Reconditioned Boilers

IN STOCK

3—225 HP Johnston Comb. Water Tube Firebox Boilers, 160# pres.
1—450 HP B. & W. Class XI #22 ASME 200#, Water Tube, boiler.
2—518 HP Heine 200# pres. 2 hor. drum Water Tube boilers.
1—585 HP Erie City 2 drum Vertical Water Tube ASME 185# boiler.
Also—30 H.R.T. and portable type boilers up to 150 HP.
¾ Yard Orton Model T Caterpillar Crane, 45 ft. boom.

NELSON MACHINERY COMPANY

Green Bay, Wisconsin

USED WATER TOWERS and TANKS

Bought & Sold

20,000 to 250,000 gal. capacity; oil storage, pressure, steel, wooden and glass-lined tanks; boilers, sprinkler systems, pumps and piping.

EVEREADY ELECTRIC & SUPPLY CO.
Bridgeport, Conn.
E. J. McCallum, Jr., Pres.

1200# Pressure Air or Gas Compressor

Worthington, horizontal, three-stage, steam-driven. Formerly used for CO_2.

DENNY & CLARK
910 N. Marshfield Ave. Chicago, Ill.

WE BUY AND SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
678 Lake Ave., Rochester, N. Y.
Tel: Glenwood 6783

PIPE
CUT TO SKETCH ⅛ to 24"
METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCKS
STEEL--WROUGHT IRON--CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 EAST 31st STREET, N.Y.C.
HOURLY NATION-WIDE SHIPMENTS
Phone MU rray Hill 3-3408
FLANGED VALVES & FITTINGS

COMPLETE POWER PLANT

Will sell subject government regulations and prior sale about March 1, 1943—3 Skinner Unaflow Engines with Westinghouse generators and exciters rated 1000—375—62½ KVA, all 440V—60 C 3 Ph. Also include 2 HRT Nu-Way Boilers rated 255 BHP each with Whiting Stokers, etc. Plant operating open for inspection. Sell as entire unit only.

P. O. Box 852 La Crosse, Wis.

PRICED RIGHT FOR QUICK SALE

Crane Type MOTORS

7½ HP GE MTC—5200 Model C-2 3/60/440V AC 1080 RPM
11 HP Westinghouse Type 462A Model 290169 3/60/220—4400V AC 850 RPM
15 HP Westinghouse Type 558 Model 294652 3/60/220—440V AC 690 RPM
20 HP GE Type MT-536 Model 12E—180 3/60/220V AC 685 RPM
20 HP GE Induction Type Mt-536 Model 22E—268. 3/60/220V 555 RPM
41 HP GE Type CO-2004—250V DC

Miscellaneous Type Motors

7½ HP Westinghouse Type HK 230V 800 RPM
15 HP Westinghouse Type HK 230V DC 700 RPM
25 HP Westinghouse Type HK 230V DC 600 RPM

7½ HP GE Type KT-952, 220V AC 1165 RPM
20 HP W-E Type KT-322 Model 1698 220V AC 865 RPM
22½ HP Lincoln Frame I-J 220V AC 900 RPM
25 HP Wagner Type 22TB 3/60/440V 850 RPM
30 HP Wagner Type BP Model 22T 220V AC 850 RPM
35 HP F-M Induction Type 220V AC 900 RPM

SCULLY MACHINERY & EQUIPMENT CORP.
2031 West 74th Street Chicago, Ill.

FOR SALE:

CONDENSERS

1—500 KW Ingersoll-Rand barometric condenser

1—2000 KW Allis-Chalmers low level jet condenser with 3500 GPM centrifugal removal pump

PUMP

1—500 GPM 160 ft. head Allis-Chalmers centrifugal pump, direct connected on common base to one: 3/60/440 volt, 40 HP motor

RALPH H. ROGERS & CO.
306 MILLSAPS BUILDING
Capitol and Roach Streets
JACKSON, MISSISSIPPI

FOR SALE

COMPLETE POWER PLANT

With two 516 H.P. Stirling Boilers, two 500 KVA turbine driven Generators with barometric condensers, Cookson water heaters, super heaters, chain grate stokers, and all necessary piping. Also steam driven compressors, steam driven hoist, approximately 20,000 feet of 1½" and 1¼" cable. Also seven 250 H.P. 120# working pressure Firebox Boilers and a number of HRT Boilers.

P. O. Box 1931, Butte, Montana

FOR SALE

WESTINGHOUSE MOTOR

75 H.P., 700 R.P.M., 60 Cycle 3 Phase, 220 Volt, with Rails.

J. HUNGERFORD SMITH CO.
Rochester, N. Y.

FOR SALE

One 100 K. W. 250 volt D. C. **Turbo Generator Turbine-Curtis** Form C, 2 stage 3600 R.P.M. 150# S.W.P.
Generator—100 K.W. General Electric Type MFC, Class 4-100-3600 Form T, 400 Amps. 250 volts D. C.

PILOT MARINE CORP.
25 Beaver Street New York, New York

FOR SALE

FUEL OIL STORAGE TANKS

From 5,000 Gal. to 100,000 Gal.
5,000 Barrels—10,000 Barrels—20,000 Barrels
Immediate Delivery—Material

ACQUISITION ENGINEERING
439 Penobscot Bldg. Detroit, Mich.

FOR SALE

500 HP 175#, Vogt Boilers, Chain Grate Stokers—Steam Pumps—Valves & Piping—833—25—15 KVA Transformers.

AMALGAMATED ENGINEERING & RESEARCH CORPORATION
100 West Monroe St. Chicago, Illinois

FOR SALE

COCHRANE OPEN TYPE BOILER FEED WATER HEATER OF APPROXIMATELY 25 H. P. AND EQUIPPED WITH TRAYS.

FS-510, Power
330 W. 42nd St., New York, N. Y.

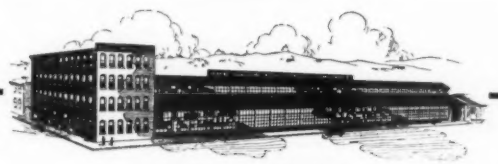
FOR SALE

1—140 K.W. 220 volt, 3 phase, 60 cycle, 3600 RPM. Allis Chalmers generator and exciter direct connected to non-condensing steam turbine, 150 lbs. pressure with switchboard complete.

SUPREME LAUNDRY CO.
4224 W. Division St. Chicago, Ill.
Phone: Spaulding 2500

NEW and USED EQUIPMENT AVAILABLE

for
Power Plants, Sub-Stations, Transmission Lines and Construction
Send for new list . . . to
—APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED, TWO RECTOR ST., NEW YORK, N. Y.



AT YOUR SERVICE

120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

•

D.C. & A.C. STEAM ENGINE GENERATOR UNITS

1— 75 KW 125/250 V. West'h. d. c. to 13½"x14" Chuse, 275 RPM
2—100 KW 125/250 V. Allis-Chalmers d. c. to Fleming Harrisburg, 4 valve, 225 RPM
1—125 KW 125 V. West'h. d. c. to 15"x16" Skinner, 250 RPM
1—150 KW 250 V. G. E. (W-E) d. c. to 16"x20" Ball, 4 valve, 200 RPM
1—150 KW 125 V. Triumph d. c. to 14"x36" Rice & Sargent, 4 valve, 150 RPM
1—200 KW 125 V. Triumph d. c. to 16"x36" Rice & Sargent, 4 valve, 150 RPM
1—200 KW 125 V. G. E. d. c. to 15 & 25"x20" Tandem Compound Skinner, 210 RPM
1—200 KW 250 V. G. E. d. c. to 18"x24" Chuse Corliss, 200 RPM
1—300 KW 125 V. Triumph d. c. to 22"x36" Rice & Sargent, 4 valve, 125 RPM
2—300 KW 250 V. Elliott d. c. to 21"x28" Elliott, 4 valve, 165 RPM
1—150 KW 2300 V. 3 ph. G. E. d. c. to 14"x36" Rice & Sargent, 4 valve, 164 RPM
1—150 KW 240 V. 3 ph. G. E. d. c. to 16"x18" Erie Ball, 4 valve, 225 RPM
1—200 KW 480 V. 3 ph. G. E. d. c. to 16"x36" Rice & Sargent, 4 valve, 164 RPM
1—250 KW 240 V. 3 ph. Allis-Chalmers d. c. to 22"x20" Skinner 200 RPM

THE GLOW ELECTRIC CO.

945 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

Used Equipment

FOR SALE

1—100 HP Heine Boiler

180 psi, 100° F. sup. Kelly shaking grate

1—300 KW Westinghouse Turbogenerator

375 KVA, 3/60/2400 150 lb. sat., 28" vac., with red. gear, LeBlanc condenser, condenser turbine and switchboard

3—100 KVA Transformers

Westinghouse, 13,200/2,300 Volts

Muscatine-Louisa Drainage District No. 13
Court House
MUSCATINE, IOWA

IMMEDIATE DELIVERY!

MODERN 1000 H.P. POWER HOUSE

WITH: 5–150 HP H.T. BOILERS, A.S.M.E., 150# PRESSURE INDIVIDUALLY COAL FIRED, with DETROIT UNDERFEED STOKERS, HOPPERS, AUTOMATIC ASH REMOVER, PUMPS, ENGINES, STACKS, GAUGES, etc.

Complete description, photographs and Blueprints, sent upon request

WRITE—WIRE—PHONE

INDUSTRIAL PLANTS CORPORATION 90 West Broadway, BArclay 7-4185 New York City

AC GENERATORS
150 KW. 600 RPM. 3/60/220, Gen. Elec. ATB
150 KW. 225 RPM. 3/60/2300, Ft. Wayne 2 brg.
200 KW. 720 RPM. 3/60/240, Gen. Elec. ATB

SQUIRREL CAGE MOTORS
35 HP. 720 RPM. 3/60/220-440, Gen. Elec. IK
40 HP. 1800 RPM. 3/60/2300, Gen. Elec. KT
50 HP. 1200 RPM. 3/60/220-440 Wagner

SLIP RING MOTORS
40 HP. 1800 RPM. 3/60/220-440, Fair. Morse BB
40 HP. 1200 RPM. 3/60/2300, Gen. Elec. MT
40 HP. 600 RPM. 3/60/220-440, Gen. Elec. IM

DC GENERATOR
75 KW. 250 Volt 500 RPM. Northern 2 brg.

PLATING GENERATOR
2500 Amp. 6 Volt, 900 RPM. Zucker Leavit & Loeb

CENTRIFUGAL PUMP
1000 GPM. 170' head, Fair. Morse 5" two stage

OIL CIRCUIT BREAKER
1200 Amp. 7500 Volt, Gen. Elec. FK-32, 3 P. ST.

Rockford Electric Equipment Co.
721 South Wyman St. Rockford, Illinois

FOR SALE
1—180 H.P. **Allis-Chalmers**, Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
1—280 H. P. **De La Vergne**, Horiz. 2-Cylinder 20" x 34" Full Diesel Solid Injection, Direct Connected to 250 Kva G-E Generator 3/60/2300 V.
Both have Exciters, and Switch Boards
All Ready for shipment—Kansas City. Write
W. L. Sullivan, P. O. Box 236, Oklahoma City

GENERATOR SETS

#1—Direct Current—#14620—I.S.
6691—Frame 6.25
Type—MPL 6—25 HP—Form 2F
KW—25 Amp. 200—Speed 325
Voltage—No. Load 115—Full Load 125
Bore & Stroke—9 x 10
PRICE $1100.00

#2—Direct Current—#15433—I.S.
6677—Frame 6.37½
Type MPL—HP 35—Form 2F
KW—35—Amp. 280—Speed 300
Voltage—No. Load 115—Full Load 125
Bore & Stroke—11 x 10
PRICE $1400.00

JOS. PULICI
Hawley, Pa.

FOR SALE

1—520 HP HAMILTON CORLISS ENGINE GENERATOR SET, DIRECT CONNECTED TO G. E. 360 KW GENERATOR, 3/60/480 VOLT, 150 RPM, WITH G. E. EXCITER AND WESTINGHOUSE 3 PANEL SWITCHBOARD.

Several Boilers, from 100 to 500 HP, with and without Stokers.

"Your inquiries solicited"

BRILL Equipment Co
183 VARICK STREET NEW YORK

WATER TOWER TANKS

1—30,000 Gallons
2—50,000 Gallons
100 ft. high Good Condition
Immediate Delivery

ACQUISITION ENGINEERING
439 Penobscot Bldg. Detroit, Mich.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

March Specials

1—40 KW C-W Type CCD, 250 v., 1100 RPM
1—25 HP GE-MTC 3/60/550/720 New
2—30 HP C.W. 3/60/220/900
2—50 HP A.C. Slipring 3160/220/900
Wanted 550 Volt Motors. All Sizes.

MILTON WERBY & CO.
423 Atlantic Ave. Boston, Mass.

FOR SALE

STEEL TANKS EXCELLENT CONDITION

1—10x30' **Horizontal Tank** located Carthage, Tenn.
2—10x16 **Vertical Tanks** located Chattanooga, Tenn.
1—10x30 3 compartment horizontal **Welded Tank** with steel supports located Sweetwater, Tenn.
1—20x25 **Ver. Riv. Tank** located Sweetwater, Tenn.
1—20x30 **Ver. Riv. Tank** located Charlotte, N. C.
1—10x30 **Hor. Welded** with steep supports, located Trenton, Tenn.
1—10½x25 **Ver. Riveted** located Clarksville, Tenn.

GLAZER IRON & METAL COMPANY
610 Chamberlain Street Knoxville, Tenn.

DIESEL ENGINES AND GENERATOR SETS

IN OUR STOCK

1—20 HP Fairbanks-Morse
2—50 HP Int. Harvester UD-9
1—50 HP Cummins*
1—68 HP Buda*
1—80 HP Atlas Imperial*
2—100 HP Fairbanks-Morse
1—112½ HP Buckeye
2—120 HP Atlas*
1—150 HP Hercules*
1—180 HP Fairbanks-Morse
1—360 HP Fairbanks-Morse
1—440 HP Ingersoll-Rand

*Fitted With Clutch and Power Take-Off

A. G. SCHOONMAKER COMPANY
50 CHURCH STREET PHONE—WORTH 2-0455-6-7 NEW YORK, N. Y.

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Aircraft & Diesel Equipment Corp.....198
Airetool Mfg. Co.....*
Air-Maze Corp.....*
Air Preheater Corp.....189
Air Reduction.....271
Alco Products Division.....*
Aldrich Pump Co.....*
Alexander Hamilton Institute, Inc.....277
Allen-Sherman-Hoff Co.....*
Allis-Chalmers Mfg. Co.....17, 19, 31
Allpax Co., Inc.....140
American Blower Corp.....212–213
American Brass Co.....237, 283
American Chain & Cable Co.....144, 157
American Chimney Co.....*
American Coal Burner Co.....*
American District Steam Co.....287
American Engineering Co.....10–11
American Locomotive Co.....*
American Metal Hose Branch.....237
American Pulley Co.....195
American Pulverizer Co.....*
American Radiator & Standard Sanitary Corp.....212–213
American Water Softener Co., The.....*
Anchor Packing Co.....223
Anderson Co., V. D.....137
Armor-Clad Co.....284
Armstrong Machine Works.....54–55
Askania Regulator Co.....*
Atlas Valve Co.....*

Babbitt Steam Specialty Co.....194
Babcock & Wilcox Co.....4–5
Babcock & Wilcox Tube Co.....*
Bacharach Industrial Instrument Co.....288
Badger & Sons, E. B.....206
Bailey Meter Co.....14–15
Baldwin De La Vergne Sales Corp.....121
Baldwin-Hill Co.....176
Baldwin Locomotive Works.....121
Bartlett & Snow Co., C. O.....*
Bates Co., Walter.....196
Beaumont Birch Co.....162, 172
Belmont Packing & Rubber Co.....268
Betz, W. H. & L. D.....191
Biddle Co., James G.....138
Bird-Archer Co.....262c
Black, Sivalls & Bryson.....*
Blaw-Knox Co.....127
Boiler Tube Co. of America.....226
Bonney Forge & Tool Works.....152
Borg Warner Corp.....234
Botfield Refractories Co.....192
Brickseal Refractory Co.....*
Bridgeport Brass Co.....*
Briggs Clarifier Co.....262e
Brownell Co.....284
Brown Instrument Co.....261
Brunt Equipment Co.....*
Buell Engineering Co.....180
Buffalo Forge Co.....262b
Buffalo Pumps, Inc.....258
Burgess Battery Co.....219
Byers Co., A. M.....62

Canton Stoker Corp.....*
Carborundum Co.....247
Cardox Corp.....*
Carey Mfg. Co., Philip.....260
Carrier Corporation.....281
Cash Co., A. W.....251
Chapman Valve Mfg. Co.....169
Chicago Metal Hose Corp.....178
Chicago Pneumatic Tool Co.....262h
Cities Service Oil Co.....285
Clarage Fan Co.....193
Clark Bros. Co.....*
Cleaver-Brooks Co.....*
Climax Engineering Co.....236
Cochrane Corp.....207, 238
Coffin Jr. Co., J. S.....168
Combustion Engineering Co.....44–45
Condenser Service & Engineering Co.....262f
Coppus Engineering Corp.....145
Corning Glass Works.....140
Crane Company.....133
Crane Packing Co.....255
Cryer Trap & Valve Co.....*
Cutler-Hammer, Inc.....115

Dampney Co. of America.....171
Darling Valve & Mfg. Co.....199
Dart Mfg. Co., E. M.....200
Davis Regulator Co.....150
Dearborn Chemical Co.....*
De Bothezat Div. American Machine & Metals, Inc.....164
DeLaval Separator Co.....*
DeLaval Steam Turbine Co.....58, 192
Deming Co.....*
Detroit Stoker Co.....38–39
Diamond Power Specialty Corp.....12–13
Dixon Crucible Co., Joseph.....*
Dowell Inc.....197
Dravo Corp.....205

Eagle-Picher Lead Co.....*
Economy Pumps, Inc.....174
Edge Moor Iron Works.....249
Edward Valve & Mfg. Co.....141
Ehret Magnesia Mfg. Co.....263
Elastic Stop Nut Corp. of America.....227
Electric Chemical Co.....*
Electric Controller & Mfg. Co.....248
Electric Storage Battery Co.....*
Electro Metallurgical Co.....*
Electroweld Steel Corp.....*
Elliott Co.....6–7, 270
Engineer Co.....170
Ernst Water Column & Gauge Co.....205
Eureka Packing Co.....190
Everlasting Valve Co.....*

Fairbanks Co.....161
Fairbanks, Morse & Co.....266
Fairfield Engineering Co., The.....208
Fisher Governor Co.....*
Fiske Bros. Refining Co.....250
Flexrock Co.....162
Fluor Corp., Ltd., The.....224–225
Flynn & Emrich Co.....246
Foote Bros. Gear & Machine Corp.....175
Foster Engineering Co.....262g
Foster Wheeler Corp.....34
Foxboro Co.....*
France Packing Co.....209
Frederick Iron & Steel Co.....184
Frick Co.....*
Fuller Co.....*

Gardner-Denver Co.....179
Garlock Packing Co.....177
General Coal Co.....*
General Electric Co.....18, 214, 216–217, 231
General Motors Diesel Engine Div.....262d
Gifford-Wood Co.....160
Gilmer Co., L. H.....*
Globe Steel Tubes Co.....30
Golden-Anderson Valve Specialty Co.....254
Goodyear Tire & Rubber Co.....33
Goulds Pumps.....*
Graver Tank & Mfg. Co.....240
Greene, Tweed & Co.....194
Green Fire Brick Co., A. P.....131
Grinnell Co.....Third Cover
Gulf Oil Corp.....182
Gulf Refining Co.....183

Hagan Corp.....32–33
Hall Laboratories.....52–53
Haynes Stellite Co.....*
Hays Corp.....133
Hays Institute of Combustion.....274
Henszey Co.....138
Hercules Float Works.....162
Hoffman Specialty Co.....136
Homestead Valve Mfg. Co.....*
Honan-Crane Corp.....190

Ideal Commutator Dresser Co.....270
Infilco Inc.....230
Ingersoll Rand Co.....239
International Nickel Co.....24–25, 183
Iron Fireman Mfg. Co.....46–47

Jenkins Bros.....128–129
Johns Manville.....135
Johnson Service Co.....*
Johnston & Jennings Co.....*
Jones & Laughlin Steel Corp.....*
Jones Foundry & Machine Co., W. A.....280

Keasbey & Mattison Co.....150
Kellogg Co., M. W.....241
Kennedy Valve Mfg. Co.....260
Kewanee Boiler Corp.....282
Kieley & Mueller.....184
Koppers Co.....*

Laminated Shim Co.....182
Leavitt Machine Co.....270
Leeds & Northrup Co.....Second Cover
Lincoln Electric Co.....143
Linde Air Products Co., The.....33
Link-Belt Co.....3
Lonergan Co., J. E.....186
Ludlow Valve Mfg. Co.....265
Lummus Co.....265
Lunkenheimer Co.....36–37

Macmillan Petroleum Corp.....*
Magnolia Metal Co.....*
Manhattan Rubber Mfg. Division Raybestos-Manhattan.....*
Manzel Brothers Co.....*
Mark & Co., Clayton.....267
Marley Co.....257
Marsh Corp., Jas. P.....*
Maxim Silencer Co.....245
McGraw-Hill Book Co.....280, 286
Midwest Piping & Supply Co.....*
Minneapolis-Honeywell Regulator Co.....261
Monsanto Chemical Co.....*
Morse Chain Co.....254
Multiple V-Belt Drive Assn.....173
Murray Iron Works Co.....142

National Airoil Burner Co., Inc. ..... *
National Aluminate Corp. 119
National Supply Co. ..... *
National Tube Co. ..... *
National Valve & Mfg. Co. 256
Niagara Blower Co. 286
Nicholson & Co., W. H. 186
Nordberg Mfg. Co. ..... *
Northern Equipment Co. 131
Norton Co. 276
Nugent & Co., W. W. ..... *

Oakite Products 192
Ohio Injector Co. 273
Ozalid Products Division 275

Pacific Pump Works ..... *
Peerless Pump Corp. ..... *
Permutit Co. ..... Fourth Cover
Philadelphia Gear Works 259
Pipe Fabrication Institute 218
Pittsburgh Piping & Equipment Co. 211
Plibrico Jointless Fire Brick Co. ..... *
Pomona Pump Co. 50
Porter & Co., H. W. ..... *
Powell Co., Wm. 56–57
Prat-Daniel Corp. ..... *
Pritchard & Co., J. F. 220
Proportioneers, Inc. 235

Quaker Rubber Corp. 204

Raybestos-Manhattan 274
Reading, Pratt & Cady Div. 157
Reeves Pulley Co. ..... *
Reliance Electric & Engineering Co. ..... *
Reliance Gauge Column Co. 20–21
Republic Flow Meters Co. 8–9
Republic Steel Corp. 48–49
Research Corp. ..... *
Revere Copper & Brass ..... *
Rhoads & Sons, J. E. ..... *
Rice & Co., Cyrus Wm. ..... *
Richardson Scale Co. ..... *
Ric-Wil Co. 149
Riley Stoker Corp. 96–97
Robins Conveying Belt Co. ..... *
Rockbestos Products Corp. 201
Rockwell Co., W. S. 194
Roebling's Sons Co., John A. 187
Rogers Diesel & Aircraft Corp. 16
Roper Corp., Geo. D. ..... *
Ross Heater & Mfg. Co. ..... *
Roto Co. 190
R-S Products Corp. 154

Sarco Co. 282
Sauerman Bros. Inc. 188
Scovill Mfg. Co. 26–27
Sea-Ro Packing Co. ..... *
Shaw Co., Benjamin F. 221
Shell Oil Co. 229
Simplex Valve & Meter Co. 174
Sinclair Refining Co. 244
S K F Industries Inc. 222
Skinner Engine Co. 253
Sloan Valve Co. 51
Smooth-On Mfg. Co. 182
Socony-Vacuum Oil Co. 125
Sperry Products ..... *
Springfield Boiler Co. ..... *
Square D Co. ..... *
Squires Co., C. E. 282
Standard Chemical Co. ..... *
Standard Oil Co. of California 262
Standard Oil Co. of Indiana 147–148
Star Test Pocket Pliers ..... *
Staynew Filter Corp. ..... *
Steel & Tubes Division 48–49
Stephens-Adamson Mfg. Co. 262a
Stickle Steam Specialties Co. ..... *
Stock Engineering Co. 172
Strong, Carlisle & Hammond Co. 280
Sturtevant Co., B. F. 28–29
Sullivan Machinery Co. 42–43
Sun Oil Co. 123
Superior Diesel Engine Div. ..... *
Swartwout Co. 310

Taylor & Co., W. A. ..... *
Taylor Forge & Pipe Works 272
Taylor Instrument Companies 269
Terry Steam Turbine Co., The 181
Texas Co. 232–233
Thermoid Rubber Div. ..... *
Tide Water Associated Oil Co. 242–243
Timken Roller Bearing Co. 215
Todd Combustion Equipment Co. ..... *
Toledo Pipe Threading Machine Co. 282
Tripp Metallic Packing Co. 284
Troy Engine & Machine Co. ..... *
Tube-Turns Inc. 139

Union Asbestos & Rubber Co. ..... *
Union Carbide & Carbon Corp. 35
Upper Monongahela Valley Coal Ass'n. 22
U. S. Rubber Co. 264
U. S. Steel Corp. Subsidiaries ..... *

Viking Pump Co. 188
Vogt Machine Co., Henry 167
Voss Co., J. H. H. ..... *

Walworth Co. 267
Warren Steam Pump Co. 209
Water Treatment Co. of America 156
Watson-Stillman Co. 228
Webster & Co., Warren ..... *
Wedge Protectors, Inc. 288
Westinghouse Electric & Mfg. Co. 60–61
Weston Electrical Instrument Co. 278
Wheelco Instruments Co. 146
Where to Buy 284
Wickwire Spencer Steel Co. 252
Wilson Inc., Thomas C. 202
Wing Mfg. Co., L. J. ..... *
Wolverine Tube Division 210
Worthington Pump & Machinery Corp. 185
Wright Mfg. Division 144

X-Pando Corp. ..... *
Xzit Sales Co. 277

Yarnall-Waring Co. 40–41, 117, 170
Youngstown Sheet & Tube Co. 155

PROFESSIONAL SERVICES 284

SEARCHLIGHT SECTION

(Classified Advertising)

Classification	Page
BUSINESS OPPORTUNITIES	289
EMPLOYMENT SERVICES	289
MOTOR REWINDING	289
Hunt, C. V.	289
POSITIONS VACANT	289
POSITIONS WANTED	289
SELLING OPPORTUNITIES	289
WANTED TO PURCHASE	289
USED AND SURPLUS EQUIPMENT	289-307
Acquisition Engineering Co.	306-307
Amalgamated Engineering & Research Corp.	306
Belyea Co., Inc.	292
Benjamin's For Motors Inc.	304
Berger Bros. Elect. Mts. Inc.	294
Birch Manufacturing Co.	304
Brearley, H. P.	304
Brew, Woltman & Co., Inc.	299
Brill Equipment Corp.	307
Chicago Electric Co.	299
Cobley Inc., Shank	289
Crawbuck Co., John D.	302
Davis, J. F.	302
De Mircoas, Cemento	289
Denny & Clark	305
Douglass Co., Stephen A.	302
Duquesne Electric & Mfg. Co.	295
Ebasco Services Inc.	306
Electric Apparatus Repair Co.	300
Electric Equipment Co.	289-305
Electric Motor & Repair Co.	305
Electric Service Co., Inc.	289
Ellis Co., A. Lee	300
Erie Electric Co., Inc.	301
Eveready Electric & Supply Co.	305
Fletcher Sales Co.	301
Glazer Iron & Metal Co.	307
Glow Electric Co.	307
H & P Machinery Co.	300
Hall & Co., Inc., Stephen	302
Hemphill & Co., Inc., J. L.	290
Illing Worth Engineering Co.	302
Industrial Plants Corp.	307
Iron & Steel Products, Inc.	305
Jackson-Bayley Electric Co.	300
Keystone Power Plant Eq. Co.	300
Kiemle Co., F. W.	294
Kirk Co., Wallace C.	302
Land & Co., L. J.	303
Liebmann Breweries Inc.	289
MacCabe Co., T. B.	300
Magazine Lumber Co.	289
Metropolitan Plumbing Supply Co., Inc.	305-306
Mississippi Valley Equipment Co.	304
Moorhead-Reitmeyer Co., Inc.	304
Morey Machy. Co. Inc.	305
Muscatine-Louisa Drainage District	307
National Boiler & Equipment Sales Co.	304
National Power Machinery Co.	291
Nelson Machinery Co.	305
O'Brien Machy. Co.	297
Pacific Machinery Co.	305
Penn Mchy. Co.	307
Pilot Marine Corp.	306
Power Plant Equipment Co., Inc.	298
Pulici, Joseph	307
Rearick, Charles B.	302
Rockford Electric Equipment Co.	307
Rogers Co., Ralph H.	306
Ross Power Power Eq. Co.	302
Schoonmaker Co., A. G.	289, 307
Scully Mchy. & Equip. Corp.	306
Shipman, G. I.	305
Smith Co., J. Hungerford	306
Stanhope, L. M.	289
Stewart & Co., Inc., Paul	293
Sullivan Co., Joe	304
Sullivan, W. L.	289-307
Supreme Laundry Co.	306
Tidewater Equipment & Mchy. Corp.	304
Utilities Electrical Machy. Co.	296
Walsh Co., Richard P.	304
Werby & Co., Milton	307
Wente Electric Co.	303
Wilms, Weaver & Co.	298
Woodworth Engr. Co., H. A.	289

You can take personal pride...

in what

SWARTWOUT CONTROLS

do for the efficiency of your plant

—Safety, Low Maintenance and Consistent Performance

KEEPING a capacity-strained power plant running these days without mis-hap or outage is an achievement you can be proud of. It's never much consolation to place the blame for break-downs on equipment that may not have been able to stand the punishment. • Just as you power engineers gain enviable reputations based on performance and experience, so Swartwout Power Plant Equipment is called for more frequently than ever as new records are made in years of trouble-free service—consistent service that is practically without maintenance expense. • Simple design, rugged construction, easy adjustment features make Swartwout Controls constantly dependable. They're serving faithfully in thousands of plants today.

The Swartwout Co.
18501 Euclid Ave., Cleveland, Ohio

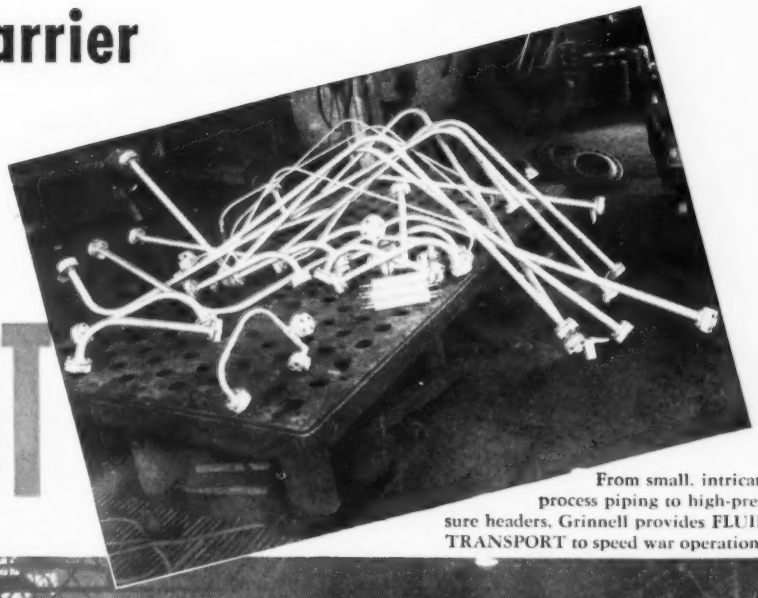
Feed Water Regulation
Nearly 600 complete Swartwout Feed Water Regulators chosen for critically important sea service
because they've given
Pressure Control
Swartwout Controls help you keep profitable power service flowing
with Safety Efficiency and Economy
Feed Water Heating
Swartwout Standard Heaters engineered to your needs
...meet all tests—assure you lifetime trouble-free service
Swartwout
Power Plant Equipment
Liquid Level Control
"Duplicate Previous Order" spells SATISFACTION with these Swartwout Liquid Level Controls
Reducing and Desuperheating
You can bank on safe, rigidly controlled steam temperatures with Swartwout Desuperheaters
Whirl the costly hazards out of your steam with Swartwout Separators
Positive separation, without pressure loss
Separation

Swartwout

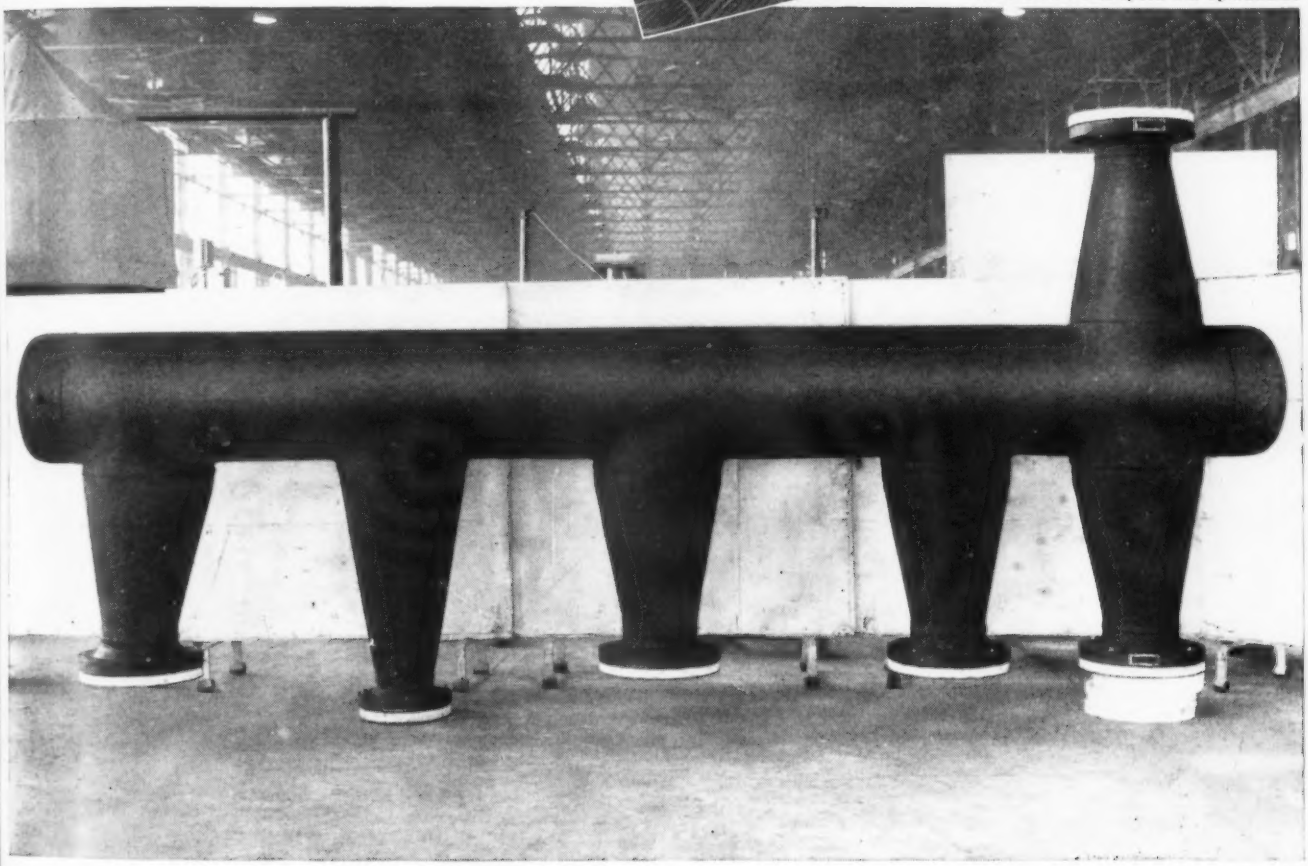
•Power Plant Equipment•

The Nation's 5th Carrier

FLUID TRANSPORT



From small, intricate process piping to high-pressure headers, Grinnell provides FLUID TRANSPORT to speed war operations.



In the Nation's war-production plants, Grinnell Prefabricated Piping is providing FLUID TRANSPORT for steam, air, gas and liquids – vital services for production.

In power stations, aviation gasoline refineries, synthetic rubber plants, fighting craft and merchant ships, Grinnell has furnished the experienced piping engineering to solve widely varied piping problems.

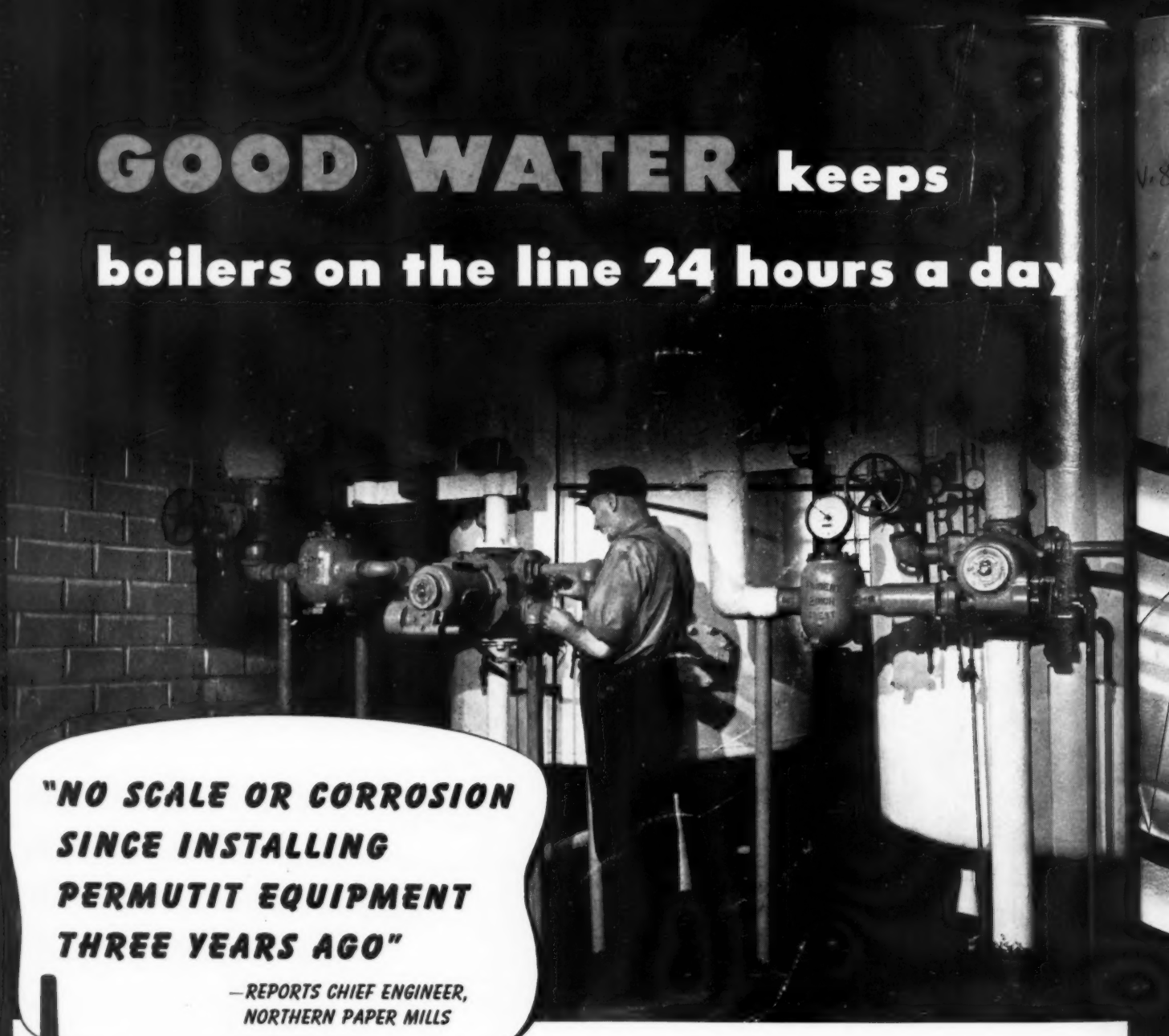
Grinnell plants, at strategic points, afford modern facilities for fabricating the connecting links which convert a pile of pipe into a complete piping system for efficient wartime FLUID TRANSPORT.

Write for Data Folder, "Grinnell Prefabricated Piping". Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of the United States and Canada.

PREFABRICATED PIPING BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

GOOD WATER keeps boilers on the line 24 hours a day



"NO SCALE OR CORROSION SINCE INSTALLING PERMUTIT EQUIPMENT THREE YEARS AGO"

—REPORTS CHIEF ENGINEER, NORTHERN PAPER MILLS

Northern Paper Mills of Green Bay, Wisconsin, use large quantities of water for processing as well as for boiler-feed. They formerly obtained power from hydro-electric plants, but in 1938 decided to erect a modern steam plant. This has resulted in a constant flow of power to maintain 24-hour operation.

The new plant has a high pressure boiler operating at 650 pounds gauge and 700 degrees total temperature. Raw water, from a deep well, shows hardness of 240 ppm. Makeup is about 50 percent.

The exacting demands of the new boiler and the hardness of the water made modern water conditioning essential. So Permutit Zeo-Karb* H and Na Softeners (shown above) were installed, with a Permutit Deaerating Heater and a Permutit Condensate Filter.

Mr. H. W. Gochnauer, Chief Engineer, reports that the boilers, inspected every six months, show *no scale or corrosion.* Tests show continuous zero oxygen. Mr. Gochnauer expressed complete satisfaction with the equipment.

This example is typical of thousands of steam plants. Why not give *your* boilers this protection? The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary.

* Trademark Reg. U. S. Pat. Off.

PERMUTIT

SERVING INDUSTRY AND THE ARMED FORCES . . . WITH GOOD WATER